Editorial

LOOKING back over the last 18 months of technical development, one cannot but be struck with the large amount of activity which has taken place in the field of sound.

An excellent illustration of this is found in the advertisements being featured in English and American journals. Here we find a huge array of loudspeakers all claiming greatly increased frequency range and power handling capacity, coupled with lower distortion and a sensitivity well beyond possibility some years ago.

Technical papers dealing with reproduction and recording are literally pouring from various individuals and laboratories, many of which have pointed the way to fundamental changes in design.

Gramophone pick-ups have undergone probably the greatest change of all, most striking of which has been the rise to prominence of the lightweight magnetic type with vastly improved characteristics.

A good deal of this activity has been complementary to the big changes in the record industry. The advent of television and FM, seen to best advantage in the larger types of receivers, has undoubtedly focused more and more attention on sound.

How this movement will affect radio generally is hard to say. I feel that it must lead inevitably to improvement in all radio reception standards, although these have always tended to lag somewhat behind the very best that can be achieved. The real enthusiast has always been prepared to go further than the general public in chasing the ultimate in sound.

Despite what has been done, I am sure that this ultimate standard is still in the future. Good though sound can be at the present time, I feel that before this intensive burst of activity burns out we will be able to hear results which will astound those used to the old standards. After all, it is not so many years ago when high fidelity meant 50-7500 cycles. This standard has now been left behind, and the battle against distortion, which must be won if the full effect of a wider range is to be used, is well on the way to victory.

Our readers can be assured of much interesting material as time goes on, to help them make the most of what can be done.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

EDITOR
JOHN MOYLE
S.M.I.R.E. (AUST.)

TECHNICAL EDITOR
NEVILLE WILLIAMS
A.M.I.R.E. (AUST.)

TECHNICAL STAFF
RAYMOND HOWE
MAURICE FINDLAY
PHILIP WATSON

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OUR COVER PICTURE

TURBINE FOR EXTRA POWER—Engineer points to the outlet from the exhaust turbine which steps up engine power by 550 hp. See story on page 23.

NEW POWERHOUSE OF R.F. ENERGY

This picture of the new valve shows that, despite its enormously high rating—reputed the highest for any valve—it is comparatively small in size. High accuracy required in manufacture will make this valve costly to manufacture and use.

New fields in the application of RF power are made possible by this giant, new valve which is capable of handling an input of one million watts. The valve incorporates new design features which in effect group 48 separate triodes in a small space. Its capabilities have not yet been fully explored.

AFTER several years of development, a transmitting power tube, believed to be the most powerful ever produced, with a continuous output of 500,000 watts and tested input twice that wattage, has been announced by the RCA Tube Department.

Despite its enormous power input capabilities—at least four times that of any previous RCA tube—the new product, called a "super-power beam triode," is unusually compact, measuring less than 39 inches in length and weighing only 135 pounds.

Immediate applications of this super-tube are in high-power continuous wave applications and international broadcast service. In addition, the tube is expected to open the way to new developments in the high-power field hitherto considered economically unfeasible or impractical because of the banks of tubes and size of associated equipment required.

FREQUENCY RATINGS

The tube can be operated with maximum ratings at frequencies throughout the "Standard Broadcast Band" and much higher. Limitations of the tube for operation at higher frequencies and at higher power have not yet been determined.

Radically new features have resulted in a structure unique in electron-tube design. The "electron heart" of the tube is an array of 48 independent unit electron-optical systems arranged cylindrically in the tube. The great power capabilities of the new tube are due largely to the successful achievement of this design, which, in effect, concentrates 48 triodes in relatively small space.

In detail, each of the independent electron-optical systems consists of a filament in a slot in the beam-forming cylinder, grid rods, and the copper anode. Electrons leaving the emitting surface of the filament are beamed between two grid rods to the anode by the focusing action of the beam-forming cylinder.

The mechanical structure embodied in the electron-optical system permits close spacing and accurate alignment of the electrodes to a degree unusual in high-power tubes.

Television Draws Nearer

Yes, but how much nearer? The point of the heading is sharpened by quite a number of events, including the rapidly deteriorating state of world affairs. We are nearer to television in that Government planning has advanced a few steps further, but frankly, I don't think television is in sight yet—not by a long way. Nor can we safely specify the delivery date of your receiver to within a month, or even a year.

GOVERNMENT planning has advanced a few steps —let me examine this one first of all.

You will recall that the previous Government's ideas on television were based on National operation to the exclusion of private enterprise. This point I think was made pretty clear during its tenure of office.

Statements were made by Mr. Chifley and others which, if accurate, would have resulted in television stations being in operation just about now. Not so clearly defined in these statements were the means by which such stations were to be brought into being.

Some time afterwards, tenders were called for the supply and erection of television transmitters. As we pointed out round about that time, the most remarkable thing about these tenders was the fact that, when called for, no set of standards for television had been released.

The tenderers did not know how many lines or frames per second were required, the frequency band, and so on, all of which would profoundly affect the tender. If this information was available, then the public never heard of it, nor did at least one big company interested in the tender.

TELEVISION STANDARDS

In fact, to the best of my knowledge, no full set of television standards has ever been laid down for Australia which would provide a manufacturer with all the information he required to make an intelligent estimate on the job of building a station.

The net result was that television got precisely nowhere. Any progress of any kind towards the provision of a service was certainly not perceptible to the naked eye.

I for one am not at all worried about the lack of action at this time, because I do not think we were in a position to decide on television standards.

Apart from England, where the prewar standards were being carried on, no country in the world had reached any stability on its television activities, and most of them were purely experimental. Moreover, there were signs that many big developments were about to break, which would radically alter the television scene long before any of our stations could get going.

I think that the history of the last twelve months has provided ample justification for that view. I think, too, that the history of the next twelve months might well decide the general pattern of television services for years to come.

For these reasons, and because I felt that private enterprise should be given a chance to use television, I expressed the opinion after the last election that the new Government should entirely review the television set-up with special reference to color television, which at that time was beginning to loom quite closely on the horizon.

I suggested, too, that an experimental period would be invaluable in the process of hastening slowly in the development of a project which will strain our technical, financial, and entertainment resources to the fullest extent.

It is obvious that the present PMG had similar ideas, for, in a succession of statements, he has indicated that private stations would be given licences, but that these would not be allotted indiscriminately. He said also that the Government would not rush into any plans without a reasonable assurance that the adopted system would give satisfactory service for a long period, and that the requirements of the television set owners would weigh more heavily with him than considerations of prestige or profit.

EXPERIMENTAL STATIONS

Lastly, his more recent statements indicate that the Government's only action contemplated at the moment would be the erection of experimental television stations and the calling for new tenders for equipment when the necessary details were determined.

And that is where the matter stands at the present time.

It is quite certain that rapid developments in the color field have had much to do with these decisions. Judging from information received from overseas, particularly America, color television is beginning to sort itself out, and, in a few months' time, it is likely that decisions will be made about its use for future stations.

No further licences are being granted in USA until this matter has been finalised by the FCC.

PROBLEM OF COLOR

It is expected that the color system eventually to be adopted will be such that either black and white, or color sets, will be able to use the transmissions with equal facility. This is important in America where many black and white sets have been sold. But it is equally important to us when considering our system, as there is likely to be a considerable difference in cost.

It is difficult to open any technical magazine from this country without encountering many articles dealing with this matter of color. In this issue we give details of a new color tube which is claimed to be one of radio's most important developments. Allowing for the natural enthusiasm of those whose future for the time being at least is tied most intimately with television, we cannot ignore the fact that our

by The Editor

own system must be one in which color as well as black and white may be accommodated. If not, it seems inevitable that by the time the stations are in operation, they will lack one of television's most important features.

In England, where the 405 line system is in full swing, very little is being said about color, and, frankly, it is rather hard to see just what will be done in that country where color is concerned.

It is almost certain that our own system will have more in common with American standards than with English, except that ours will probably provide a better picture than either, through the use of at least 625 lines.

An experimental station, when it becomes operational possibly within two years, will be of immense value to all concerned. It is, I think, absolutely essential for our engineers to obtain practical experience before embarking on such a colossal task. And it is almost as important for set manufacturers, who will have the opportunity of working virtually side by side with the transmission engineers.

I would go even further, however, and allow more latitude in this matter of experiment, and permit operation by people other than the PMG research engineers.

CONTROL

After all, television has very wide implications and uses apart from broadcasting, and there seems no reason why we should not be allowed to exploit it to the full.

Careful control of frequencies and general administration will be needed, of course, but any reasonable request to carry out experimental work within these limits should receive consideration in an effort to make the ether available to those who want to use it.

Once again, I would point to the need for knowledge and experience in the programme side of television. In this matter, general opinion seems to be that everybody has a great deal to learn—so much, in fact, that the basis of good television technique has not so far emerged with any clarity. It is hard to imagine things otherwise, for if we are approaching the ultimate medium for human instruction and entertainment, we are also learning that it is the most difficult to use.

A mix-up of the technique which has proved satisfactory for the stage and for radio isn't enough.

Frankly, I would hate to imagine that we cannot improve on the general standard of radio programmes for television. Similarly, I cannot accept a duplication of the theatre as being a good fare for daily consumption in the intimacy of the home. The tremendous impact of sight and sound on the human mind is something we must use with the greatest of caution. Otherwise we may find ourselves at one with an American writer, who said—"Out of the wizardry of the television tube has come such an assault against the human mind, such as mobilised attack on the imagination, such an invasion against good taste, as no other communication medium has ever known."

Those are strong words, and we must pay heed to them. I doubt whether Australia has programme resources of a higher standard than the country which has earned such comment.

The dangerous effect of television on the willingness of people to think for themselves is a very real one, particularly in relation to children. Figures again taken out in America indicates that many of them spend as much time looking at television screens as they do at school.

If that proportion should not hold to anything like the same extent in Australia, we must be sure the diet is a little more demanding than Superman and his ilk.

If all this seems to paint a depressing picture, I would say that any review of the effects of television on home audiences which I have read stressed these things not merely as possibilities, but as facts which have been observed and tabulated.

It cannot be denied that side by side with these dangers of television can be listed its equal potential for good. The point I am underlining is that the best technical effort in the world will not benefit our community unless equal effort is expended to provide good programmes. Bad programmes can be devastating in their psychological harm, and the render still easier the insidious tendency to be content with mere entertainment in our leisure hours.

WORLD EVENTS

A television system which allows the balance between National and commercial stations to be preserved as it now is in radio is probably the best guarantee we can muster that our programmes won't be as bad as they might be in America, for instance, where the unrestricted competition is seen in full development. It is, on the other hand, one way in which we can avoid the danger of stations becoming merely a Government mouthpiece. In a world replete with so many examples of both dangers, it is wishful thinking to imagine that neither could happen here.

The almost universal reaction of visitors to our shores is that we are fortunate in having both types of stations. If we can continue to capitalise on the virtues of each, and avoid their respective pitfalls, then we are on the right road. For my part, I cannot see why wise direction should not give us the basis of a splendid service in the days to come.

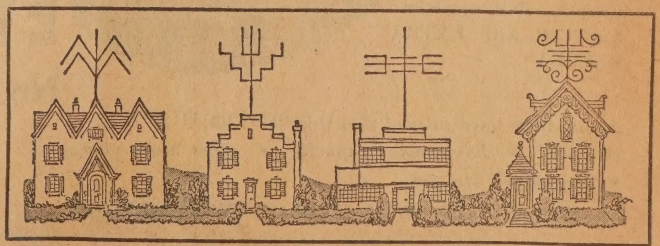
This brings me to a final point, which is the possible influence of march of events in Asia on our television plans. So rapidly is the position deteriorating as I write these lines that the possibility of the country being more or less involved in another conflict cannot be ignored.

Should this come about, and our radio potential be called upon to produce equipment for war rather than for peace, I think we can say goodbye to television as we visualise it until more urgent matters are resolved. Already plans are being announced for the extension of the armed forces, and it is highly probable that this extension will mean the design and manufacture of radio equipment. It may be, too, that we shall have to think of needs other than our own in this matter, in a plan in which our proportion of a task may be a large one.

POSSIBLE REVOLUTION

Should this come about, I would expect the urgency of the times to bring about a development in techniques which could quite easily change entirely the face of television as we now know it. I have always thought present-day television as being far too complicated to last for more than an era, giving way sooner or later to a system vastly superior in its simplicity and low cost. This is another reason why I think we must forget television if our present plans are interrupted by unfavorable world conditions.

Apart from the whys and wherefores of the matter, the birth of television has been a fascinating study, both technically and psychologically. We can be quite sure that when it comes to us, its profound influence on our daily lives will be just as great as it has been in other parts of the world.



RADIO & TELEVISION NEWS

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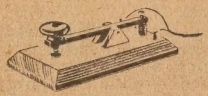

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LARGEST SUPPLIERS OF DRY BATTERIES TO THE AUSTRALIAN GOVERNMENT AND DEFENCE FORCES

A NEW BRITISH ATOMIC MACHINE

The problem of scale is among the most serious the engineer has to face. At first sight it might seem that to make a house, or a bridge, or an aircraft, or a ship, twice as big as one already proved successful, should be quite easy. All that ought to be necessary, it might be thought, would be to double all the dimensions of the original and the desired result would be achieved. In fact, it is far more difficult.

By TREVOR WILLIAMS

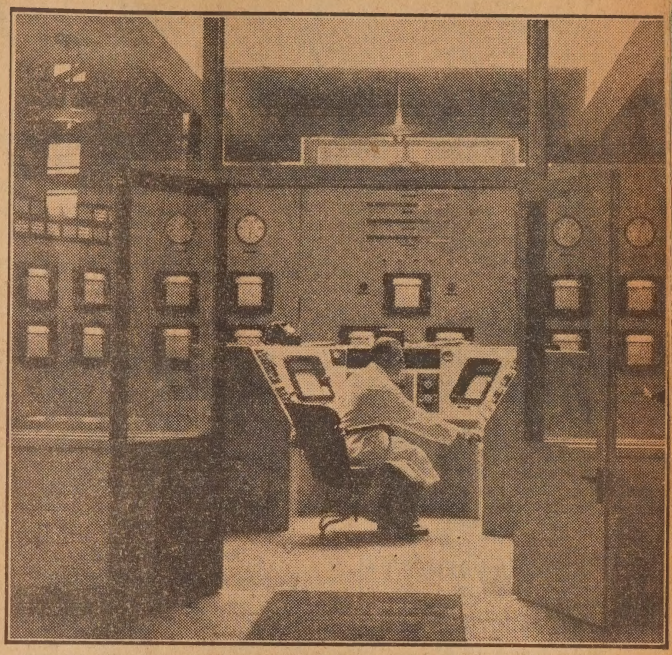
THIS is because all sorts of important properties do not increase in proportion to size. For example, if we double the dimensions of an object we make its surface area four times as great and its weight no fewer than eight times as great. Strength, too, is affected. Doubling the length of a girder makes it many times easier to bend.

Perhaps the most familiar example among many no less important is in the building of aircraft. For example, the construction of the giant new Brabazon airliner just completed at Bristol, England, proved an immensely difficult and costly venture because the increase in size above that of aircraft already in service involved the designers in quite disproportionately great difficulties. Equally, the building of giant liners, such as the Queen Elizabeth, involves far more than merely enlarging the design of smaller vessels.

In the large-scale application of scientific methods which have proved entirely successful in the laboratory the same situation arises. All kinds of difficulties, which not infrequently prove altogether insurmountable for economic or practical reasons, at once become apparent, and many a promising new process has had to be abandoned simply because magnification of the scale of working proved impracticable.

FOR SEPARATING ISOTOPES

Against this background a new piece of equipment just brought into operation at Britain's Atomic Energy Research establishment at Harwell, in southern England, is of particular interest, for it represents the large-scale development of one of the earliest pieces of laboratory apparatus used by the Cambridge University, England, group of atomic physicists in their pioneer work in this field. The equipment, known as an electro-magnetic separator, is used for separating isotopes, that is to say, atoms of an element which are chemically identical but differ in their weight. This separation is of the greatest theoretical and practical importance.



Production of radio-active isotopes at Britain's Atomic Energy Research Establishment is being still further increased as a result of the great demand from overseas. Exports of isotopes are already higher than those of any other atomic station in the world. British produced isotopes are exported to Australia, South Africa, Sweden, Switzerland and Holland. Special containers have been designed for transporting atom products by air. These fit into the wing-tips of aircraft, enabling isotopes to be carried without the need of heavy lead shielding against radiation. The use of isotopes make it possible for much medical treatment and research, both in medicine and industry to be carried out which would otherwise be impracticable. The power at which the atomic pile is operating is controlled by the pile operating engineer sitting at the control desk. The instruments in the panels behind indicate and record the power, the temperature at various points in the pile, the flow of cooling air and subsidiary information.

In experiments which are now classical, J. J. Thomson showed the real nature of the positively charged rays which are formed when electricity is discharged through a gas. By passing the rays through magnetic and electrical fields he was able to deflect them, the amount of the deflection depending upon both the electrical charge and the weight of the atomic particles present in the rays. Consequently, when the deflected ray fell upon a photographic plate different types of particle, being differently deflected, hit different points on the plate instead of all falling on the same spot.

Later this apparatus was improved by another Cambridge physicist, F. W. Aston, who constructed what he called a mass spectrograph. With this he was able to separate, but only on the very minute scale necessary for research purposes, atoms of the same element differing from each other in weight. For example, he showed that pure neon gas consists very largely of atoms which are 20 times heavier than hydrogen atoms together with a much smaller number which are 22 times heavier. This research was of supreme importance, because for a century an essential part of the atomic theory was the assumption that all atoms of an element had the same weight. The discovery that this was not so opened up all sorts of entirely new possibilities.

OF GREAT PRACTICAL USE

Today the separation of pure isotopes in considerable quantities has become of very great importance, for they are required both for new theoretical researches in atomic physics and for practical use in medicine, chemistry, and other branches of science. Two years ago an electro-magnetic separator similar in principle to that of Aston was completed at Harwell. Although it can handle

far larger quantities of material than the original mass spectrograph, although yields are still almost invisibly small. It has the limitation also that it can deal only with the lighter elements. Increasing the scale of the apparatus so that it could handle relatively substantial quantities of material presented for the kinds of reasons already mentioned very great technical difficulties. These have, however, at last been overcome and a machine is now in operation at Harwell with an output at least 1000 times greater than that of the one constructed only two years ago. In addition, it can separate the isotopes of even heavy elements such as uranium.

The construction of this new isotope separator, in spite of the difficulties of enlarging what was originally a laboratory apparatus to what is really a small industrial plant, is justified by the results which can be obtained with it. There are several well-known ways of separating isotopes, but most suffer from the disadvantage that each passage of material through the plant brings about only a slight separation. Consequently complete separation is a long and laborious process. The great advantage of the electro-magnetic separator is that although its output is comparatively small a single operation gives a high degree of separation.

NEUTRON DETECTION

THE presence of particles called "neutrons", which are emitted by some radioactive materials and could endanger health of atomic laboratory workers, can now be detected by a new device.

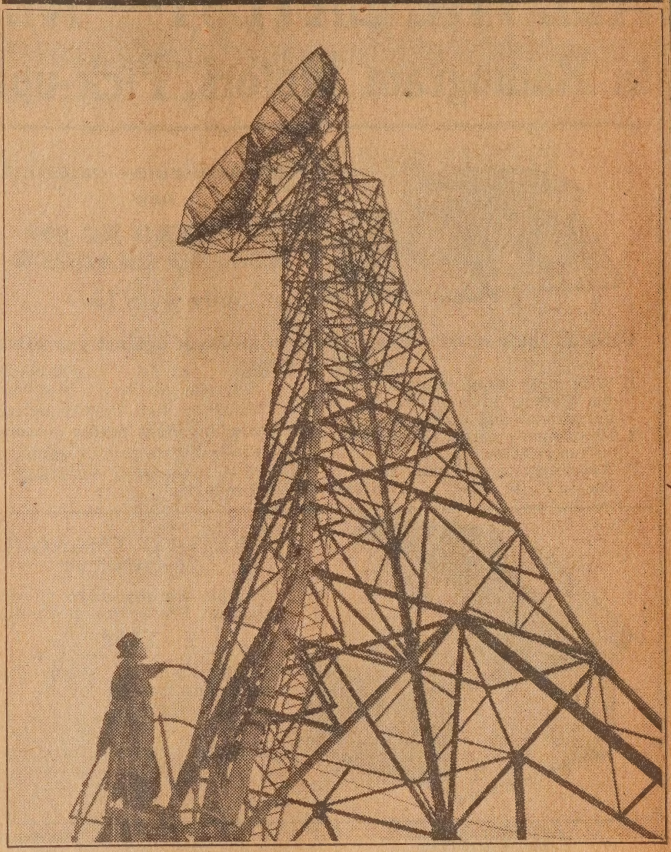
The instrument, shaped like a policeman's nightstick, is called the "neutron counter tube."

The counter tube will be useful in monitoring an area near atomic piles or atom smashers before laboratory workers are admitted to the area. The counter tube will show whether neutrons have penetrated the shields installed for protection against radiation exposure. If the instrument shows that the radiation level is unsafe, increased shielding can be installed.

Basic part of the detector is the tube's lining of the material boron, which has a special molecular property enabling it to capture the slow-moving neutrons.

When a neutron strikes an atom of boron, two particles are exploded outward in opposite directions. These particles hitting the argon gas with which the counter tube is filled cause surges of electricity from the wall of the tube to a wire stretched down the tube's centre. Each surge of current through the wire is counted. This count is proportional to the number of neutrons striking the counter tube.

BEAMING TELEVISION FOR BBC



A complicated relay link produced by British research and engineering, comprised of six stations (four of them automatic) plays a vital part in the beaming of television programmes from London to the new, giant station at Sutton Coldfield. This mast, erected on top of the Museum telephone exchange, relays television signals on a wavelength of 30 centimetres

SQUARE BEAM AIRPORT BEACON

Applied optics has recently made an important contribution to flying safety. To aid pilots, land airports throughout the world flash alternate white and green lights, water airports white and yellow ones.

BY international convention, the flashes must reach a minimum visibility from the air, expressed scientifically as 100,000 candle-seconds for white, and 15,000 candle-seconds for yellow or green light, over a maximum flash duration of half-a-second.

The London, England, firm, Chance Bros., has improved upon the above-stated requirements.

Visibility depends largely on three separate factors: the intensity of the projected beam; the duration of the flash; the angle at which the beam is viewed.

Concentrated optical and mathematical research into these factors, both singly and severally, indicated that an entirely new approach would be essential if real improvement were to be achieved. The result is a location beacon with a beam, not, as is usual, conical in shape, but square. The beacon itself has numerous refinements. Of these the most important are the inner and outer optics, embodying the results of complex calculations.

Other notable features are the revolving apparatus, which turns the whole of the lantern, and a system whereby failed lamps are automatically changed. The beacon's visibility is 300,000 candle-seconds for white lights (three times the minimum), 60,000 for green (four times the minimum), 150,000 for yellow (10 times the minimum). In good weather, it is visible at 60 miles (96 km) distance.

ALL THE LATEST—ALL THE BEST
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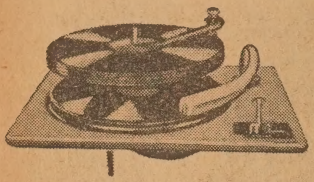

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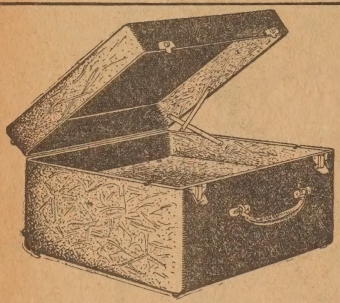

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Similar, but for single player motor and pick-up.

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Small De Luxe type for Garrards or Collaro RP504 motors.

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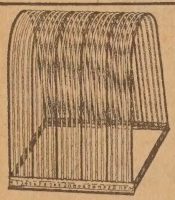

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Complete with transformer.

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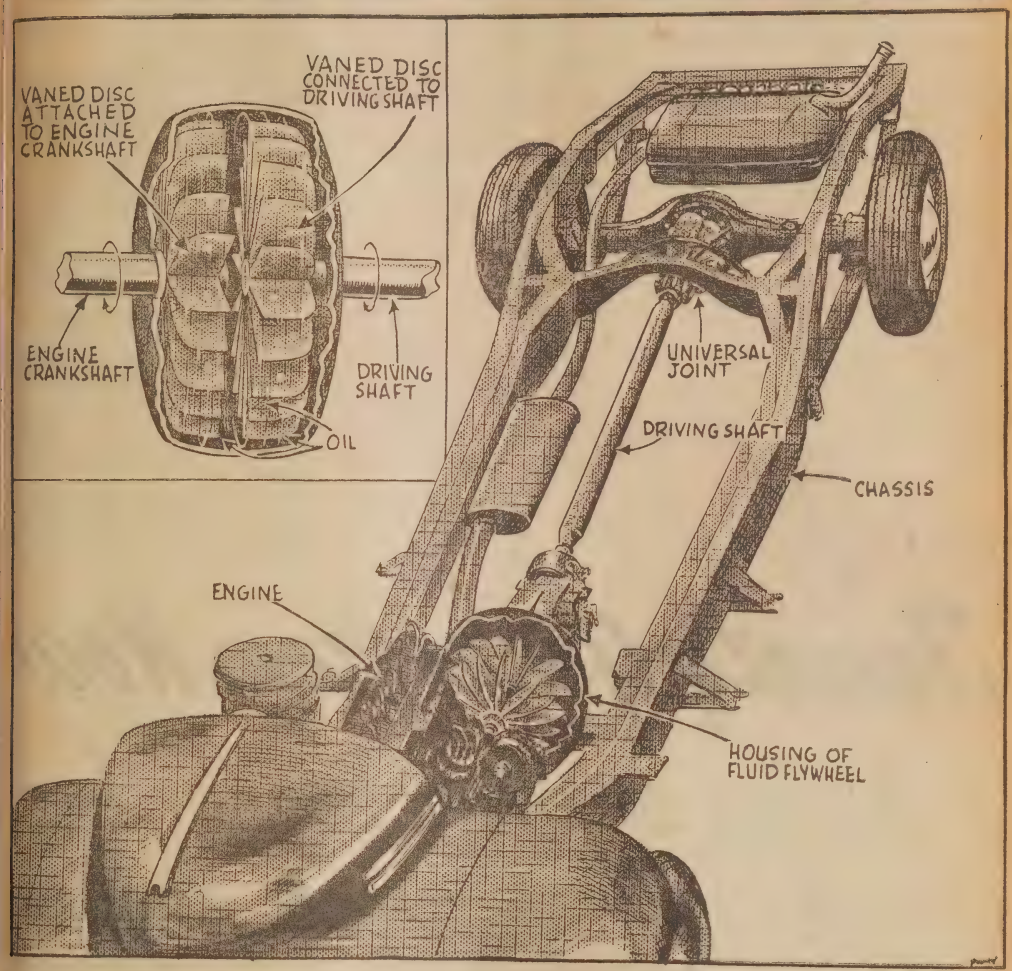
HOW IT WORKS—A FLUID FLYWHEEL



Adapted to the motor car some 15 years ago after being used in Diesel engines for driving propeller shafts in ships, the fluid flywheel is one of the biggest contributions yet made to the smoothing of motor car running. Its cost has limited its use, however.

AS can be seen from the diagram-sketch, the fluid flywheel is mounted at the rear of the engine, so as to link the crankshaft to the gearbox through oil pressure alone.

The fluid flywheel is housed within a special casing inside which two vaned discs occupy most of the space. The casing is filled with oil. The two vaned discs, or rotors, are not connected mechanically, but the power derived from the engine is conveyed through whirling oil set in motion by the forward or driving rotor to the rear or driven rotor, which is linked directly to the gearbox.

Fluid flywheels were first introduced by British car manufacturers. In more recent years they have been adapted by American car builders. The diagram-sketch above is based on explanatory material published by the manufacturers in America of the "fluid drive" system patented by Chrysler.

The principle can be explained by setting up an electric fan almost face to face with a second fan that is free to rotate. When the electric fan has attained a sufficient speed, the energy conveyed by its stream of moving air sets the second fan in motion.

In this case there would be some loss of speed if a small load were applied to the second fan—that is, if it were made to do some work.

This loss of speed is known as "slip."

In order to reduce the slip, it is necessary to bring the driving and driven parts close together and to use a fluid instead of air to convey the power from the one fan to the other.

This has been done in the case of the fluid flywheel by using two rotors mounted face to face in a sealed housing, with all the space occupied by oil.

It is the speed of the oil whirled by the driving rotor, that gives it the rigidity needed to link the two rotors and make them work as one.

(Continued on Page 16)

Twenty Years from Now

Even in the short space of time which has transpired since the words were written, many of Professor Low's stimulating and imaginative ideas are beginning to take shape. In this article, he deals specifically with the possibility of journeys into space.

IN twenty years from now every single thing you know will be entirely different. The world will have changed out of all recognition. Judge for yourself by looking back twenty years. In 1927 the Atlantic had yet to be flown from east to west in an aeroplane. Only these few years ago the first solo flight by Colonel Lindbergh was such a sensational event that it held the headlines for days.

Look up the last edition of the Encyclopaedia Britannica, published about twenty years ago, and you will find no entry for radar, penicillin, electronics and a score of inventions and discoveries which today every schoolboy understands.

The idea of "splitting the atom" was considered Wellsian—something that might happen some time, but more likely in the 21st century than the 20th and certainly not likely to trouble anyone living in 1927.

Aircraft, it was assumed, would always be driven by petrol engines, which would become more and more powerful. The "jet" engine was not even mentioned, although in fact the RAF had begun some tentative investigations which were not to be taken very seriously until ten years later.

As for rockets—they were things which boys fired on Guy Fawkes night and anyone who suggested that they might be fired from Germany to London might have risked being certified as a lunatic or a sensationalist trying to disturb international peace!

FANCY BECOMES FACT

A little earlier I had written one of my early books, The Future, and some reviewers had treated its forecasts with good humor as the work of a scientist using his imagination, or an inventor having a nightmare. Today, the book seems stale—so many of the forecasts which then seemed "sensational" have become accepted commonplaces.

Yes, a great deal has changed in twenty years. Not only in the field of the physical but in the social sciences. Men and women, their values and their customs, have undergone great changes.

We can reasonably expect changes at least as great to take place in the next twenty years. Always remember that nothing ever remains unchanged for even a part of a second. If you will read any newspaper of twenty years ago you will wonder "how it could have happened." Unless you can think forward today, in twenty years time someone will say of you, "How could anyone be so careless, so wrong or so ignorant!"

In this series I shall answer some of the questions about the future which are so often put to me.

SHALL WE HAVE REACHED THE MOON?

United States Army experimenters have sent a German V2 rocket to a height of 111 miles from the earth and shot tiny metal slugs from it during flight at a velocity sufficient for them to escape the gravity of the earth and travel into space.

This is the greatest distance to which man has yet sent anything from the earth. But it is still a long way from the moon—to be precise, 238,730 miles. Shall we in the next twenty years see rocket projectiles improved to the point where they can travel two thousand times as far from the earth as this V2 and reach the moon?

I think the answer is "yes." Twenty years ago it was easy for any mathematician to prove that Jules Verne's moonship was scientifically unsound and would never have escaped the clutches of the earth's gravity. Today, the fantasy moon journeys of Verne and Wells are approaching the realms of possibility. There no longer remain insuperable "theoretical" difficulties barring the way of escape into space.

It was the absence of any fuel capable of achieving the required velocity which made a moon-flight theoretically impossible until recently. Now the experts, inclined to be conservative, speak of a moon flight in from ten to fifty years. It seems to me that the first man-made "moon-

ship" may make its journey well within 20 years and that there are people living today who may actually hear by radio this landing on the moon.

The first flight to the moon is likely to be as unsensational as a spectacle as was the first splitting of the atom. A guided missile of some hundreds of tons will take off and disappear into the sky. Even the most powerful telescopes will not make it possible to follow its flight, not only because of its comparatively small size, but also because of its speed. At 5000 mph it would make the journey in about two days, but only its automatic radio transmitter sending back messages will enable us to know whether its flight has been successful.

BEGINNING OF A NEW ERA

As a spectacle it will be of no interest, but the public will, I believe, follow the flight communiques from scientists with breathless fascination. The tangible results will be a mass of figures unintelligible to all but a handful of experts. But so was Einstein's theory of relativity, and you will recall how this "hit the headlines" and influenced the thoughts of millions quite incapable of understanding its mathematics.

The ordinary man will understand that this first flight by an unpiloted rocket will mark the beginning of a new era, the era of space travel so long forecast by the science-fictionists. The data obtained by the pilotless rocket will make it possible to get down to the details of a passenger-carrying space-ship which will eventually embark human beings on the most important and perilous journey since Columbus set sail. With this difference, that the first passengers in a space-ship will not have unknown perils to face, but known dangers of which the chances have been nicely calculated.

Possibly, within twenty years, more probably later, the day will come when half a dozen men will climb into a space-ship designed to encircle the moon or even land on its frozen surface. They will be men chosen from hundreds or even thousands of volunteers not only for their knowledge but for their physique and courage. Even with the many aids to space flying which will have been developed, they will have to be prepared for great hardship.

GRAVITY PROBLEMS

To overcome the gravity of the earth and "escape," the space-ship must still attain a speed of 12,000 feet a second. To save the crew from being crushed like matchwood against the back of the rocket, this speed will be reached comparatively slowly, but they will still have to be strapped down and will suffer acute discomfort at all stages of the voyage.

Once acceleration slows down and the rocket cruises freely in space the passengers will have no weight. They will float in the air, and such simple things as pouring out a glass of water or swallowing food will be almost impossible. The release of all weight from the body will bring on acute sickness, far more nauseating than ship or airsickness. Indeed, I think it probable that the experimental passenger flights which will precede the first flight to the moon will show that it is essential to produce "artificial gravity" by spinning the whole rocket-ship or the cabin inside it.

In space there will be risk of collision with a meteor. Millions of them are continually flying through the void and although the majority are very small, collision with something weighing only a pound or two at very high speed would be sufficient to destroy the space-ship. Once the pressurised cabin was punctured, death from cold would be a matter of moments. It may well be that the accident rate with early space-ships will be high, although calculation of meteoric frequency suggests that this particular risk is less than that of crossing a main road.

In the next twenty years many of the technical difficulties of space flight will disappear. Today we may wonder how the flight of the space-ship will be checked to make a safe landing, how the space-ship will be guided, how it will be powered and so on. We can suggest crude ways of overcoming the difficulties, such as reverse firing rockets for deceleration. But I think we can be confident that technicians will solve these problems. Just think how formidable first seemed de-icing, variable pitch propellers, pressurised cabins, landing speeds of 120 mph and many other commonplaces of modern aviation, to the designers of early aeroplanes!

FIRST FLIGHTS TO THE MOON

For landings on the moon, the passengers will require special suits supplying them with warmth and oxygen. The moon is without atmosphere and there are enormous drops in temperature. Suits have, in fact, already been planned, enabling men to walk, breathe and even eat in them. They weigh two or three hundred pounds, but since gravity (and thus "weight") on the moon is only about one-eighth that on the earth, this presents no serious hardship.

by Professor A. M. Low

Light will be no difficulty. The journey will probably be arranged for the period when the earth will present a fully lit surface to the moon—a sort of "full earth." The earth reflects about 80 times as much light to the moon as does the full moon to the earth.

The first flights to the moon will be enormously expensive undertakings, far too expensive for private explorers. But given the incentive, the twenty or thirty millions that a space-ship might cost will not seem excessive to nations that spent this sum every day for years in warfare.

What will be the incentive? There will be the natural urge to explore the unknown, the possibility of discovering valuable atomic minerals and probably most of all the military aspect. Millions a year are being spent on the development of rockets today, primarily from the point of view of war, and it is this effort which makes the flight of a missile to the moon in the next twenty years seem so much more probable than it did even three or four years ago.

ROCKET-FLIGHTS OF 160 MILES

Commercially, the moon may seem as valueless as the Antarctic Continent when its exploration first began less than a hundred years ago. Expeditions to the moon may be as infrequent as Antarctic expeditions at the beginning of the century, although looking ahead it may be argued that if there are ever to be flights to other planets, it is from the moon, with its absence of atmosphere and low gravity, that they would best be launched.

This conjures up pictures of a space-ship assembly plant on the moon, with all that will involve in constructing "pressurised" factories and even towns. Today, it all seems wildly fantastic, but the discoveries of the next twenty years may make it seem no more difficult than, say, the construction of the Mulberry Harbours would have appeared to a 19th century engineer.

In fact, during the next twenty years flight to the moon will be preceded by hundreds and even thousands of others to varying distances from the earth. The Americans have stated that within two years they will be sending unmanned missiles to a height of 160 miles and manned rockets to 15 miles.

The purpose of these flights will be exploratory. A multitude of ingenious automatically recording instruments will discover all about cosmic rays, changes in temperature, reflection of radio, the danger of meteors, and many other problems that must be solved before we can venture into outer space. Postal services at vast speeds are within our power during the next few years.

SATELLITE BODIES

From these exploratory flights may come some astonishing developments. We may see the establishment of artificial satellites at varying distances from the earth. If a missile is propelled with a velocity below the 6.64 miles per second required to escape gravity it will eventually stop in space and circle the earth like the moon—but very much closer, a matter of a few thousands of miles. From its natural speed, we could ensure it circling the earth once a day, in other words, apparently remaining in the same spot all the time.

(Continued on Page 16)

A scene typical of gold winning activity. Panning a sample from a stream in search of the magic specks.

GOLD—THE MAGIC METAL

One branch of scientific investigation which receives little publicity is that of the art of assaying or the determination of the quality and constituents of metals and ores. Assaying is a very important science and has a vast influence on the metallurgical industry and through it the whole ramifications of the machinery industry, and those industries using metals in manufacture.

by Calvin Walters

THUS, practically the whole of our existence is influenced by the science of assaying, for without it metals could not be brought to the stage of purity necessary for efficient processing.

Every large smelting works has its own assay office. Every mine of any consequence which mines metal ore boasts an assay office.

In one of these offices one sees bottles of chemicals arranged in rows similar to any chemical laboratory. The number of these chemicals or reagents, as they are called, varies according to whether the industry is dealing with a large number of ores or only individual ones, like gold or silver.

Small furnaces are a necessary part of an assay office, as is, also, a means of crushing samples of the ore.

The methods of assaying are not at all difficult to understand, and are very interesting. Perhaps it will be well if we take, as an example, one of the most important metals, such as gold, and follow an assay through.

We will assume we have found a gold mine. This is the dream of almost everybody in this world at some time or other, so that our assay should be all the more interesting.

It is first of all necessary to take a representative sample of the ore which contains the gold. For this we do not take any piece of ore which comes to hand.

Many a man has fooled himself by taking a piece of ore richly studded with gold and working on the idea that all the ore in the mine is like that particular sample.

A mine could contain only one or two pieces of ore like that, all the rest being stone with no gold in it mixed with stone containing only a few specks. Yet in one ton of the ore there may be sufficient gold to make the mine payable.

The idea of a gold assay is to find out how much gold there is in one ton of ore and thus determining whether it would pay to work the mine. We also wish to know whether the gold is pure or whether it is mixed with other minerals, for we must also bear in mind the old saying that "all that glisters is not gold."

SAMPLING

Sampling is the most important process which precedes actual assaying. It is carried out with the idea of obtaining in a few ounces of the ore a correct representation of the whole quantity, be it a few pounds or several tons.

Several methods are used in sampling. Should the ore be in a large heap, the method known as "trenching" is usual adopted. This consists of flattening the heap and digging trenches across it at regular intervals, until the whole looks like a checked board.

Small samples are taken from each square in the heap until a quantity equal to one-twentieth of the whole is obtained.

It is obvious that the samples must not be taken by selection, but must be taken at random from each square.

This aggregate of samples from the squares is now crushed until the pieces are reduced in size and the number of pieces is theoretically equal to the number of pieces in the main heap.

This is now thoroughly mixed and formed into a ring. Then from the outside of this ring the ore is taken and thrown into the centre in the form of a cone.

This cone is now divided into four by drawing two diameters across it and two opposite quarters are rejected. The remainder is now mixed and the process repeated until the remainder of the ore is of sufficient weight to assay.

It will thus be seen that sampling is a very important process.

In some cases, samples of ore must be taken from a load on a skip. In such cases, every twentieth waggonfull is put aside to make up part of a heap to be sampled. Likewise, every twentieth bag is used when the ore is delivered in bags.

It is during the sampling stage that sometimes dishonesty takes place. Perhaps a mine-owner wishes to sell out. In order to make the mine appear richer than it really is, the dishonest person may introduce by stealth some gold dust or gold filings into the sample.

Sometimes gold chloride is injected into sealed bags by means of a hypodermic syringe. There seems no limit to the methods which can be thought out by dishonest traders.

The above method of sampling is not always used. Sometimes it is done by machinery, but the general idea is the same.

When the final bulk sample is obtained, it is sealed in bags and sent on to the assayer, where it is subjected to further crushing.

FURTHER DIVISION

Perhaps the sample is too large for the assayer. In such cases, he again crushes it and divides it again and again until he has what he wants.

The final sample is crushed with a pestle and mortar until it is in a fine state of division and will pass through the meshes of a fine sieve.

We now have a sample of the ore ready for assaying.

The assaying of gold among other metals depends on the principle that monoxide of lead, commonly called litharge, is capable of absorbing oxides of other metals with which it comes in contact, thus separating them from unoxidisable metals. Gold and silver are non-oxidising metals suitable for this process.

It remains, then, for us to get the gold in the ore mixed with lead, and then get rid of the lead and leave the gold behind. Having got the gold, it is then only a matter of weighing it and determining how much there is in proportion to the original sample, and thus to the whole quantity.

FLUXES

Now back to our sample. This is carefully weighed and mixed with suitable quantities of litharge, charcoal, borax and perhaps sodium bicarbonate. The charcoal, borax and sodium bicarbonate act as "fluxes," and assist in the absorption of foreign substances and the conversion of the litharge into metallic lead.

This mixture is carefully weighed and placed in a fireclay crucible and so into a small furnace.

It is left there for some time and when withdrawn is allowed to cool off. It is then broken up when, at the bottom will be found a lump of lead mixed with the gold or silver which happens to have been in the ore. Sometimes the contents of the crucible is poured into a mould, thus saving the crucible for further use.

We now have our lead and gold mixture. This is called a lead button. The separation of the gold and lead is a simple matter.

The button of lead is placed in a "cupel." This is a small dish made of bone-ash and looks something like the little dishes which artists use to mix water-color paints in.

This cupel with the lead button is placed in another kind of furnace called a muffle furnace. Here the lead button is melted, whereupon the lead is absorbed by the bone-ash and the gold is left behind in the form of a little bead.

This bead is placed in acid so that all silver, if traces happen to be present, is dissolved out. The pure gold is left behind and can then be weighed.

ASSAYING PRINCIPLE

The principle on which the assay of silver is based is identical with that of gold. However, it may so happen that the silver may be mixed with impurities such as copper. This has to be removed, and is done in the following manner:

The silver bead is dissolved in nitric acid. This takes every impurity into solution. If, now, some spirits of salts is added to this solution (the technical term for this is hydrochloric acid), a thick white curd will form. This is silver chloride, and will not dissolve in water.

Consequently the solution is filtered and all the impurities pass through the filter, leaving the silver chloride behind. This is well-washed with distilled water and then placed in a glass dish with some pure zinc and some spirits of salts.

SPONGY SILVER

As the zinc dissolves in the acid, a chemical action takes place which converts all the white silver chloride into pure spongy silver.

When all the zinc has been dissolved, the spongy silver is well washed to get rid of the zinc solution. The silver is then dried and weighed.

Copper assaying presents a very interesting principle on which the assay is based, namely the property which a solution of potassium cyanide has of removing the blue color from an ammoniacal solution of copper.

Having treated the ore and gained the copper into solution by nitric acid, a quantity of ammonia is added whereupon the solution immediately turns a deep blue color.

A standard solution of potassium

The final result—gold at assay in Sydney, where the future of many a possible strike is decided.

cyanide is now taken in a graduated tubular measure called a burette. This has a tap at the bottom which enables the solution to be released drop by drop.

The cyanide is run into the blue copper solution until the color begins to fade. The cyanide is then added drop by drop until no color remains. The quantity of cyanide solution required is noted.

By previously testing the cyanide solution against a known weight of pure copper, the quantity of copper in the dissolved ore is easily calculated.

Another interesting method for copper assay is similar to that of the silver assay. Remember that a piece of zinc dissolving in the silver chloride converted the chloride into silver.

In the copper assay a similar process is used, except that a piece of aluminium is added and sulphuric acid is used, instead of hydrochloric.

The aluminium causes pure copper to be precipitated, which is well-washed and assayed by the cyanide process just described.

ASSAY OF IRON

An assay of iron when the iron is free of other metals takes about 10 minutes.

For the process, a weighed amount of ore is dissolved in hydrochloric acid. The resulting solution is of a yellow color.

Into this is added drop by drop a standard solution of tin chloride until the yellow color fades out. The amount of iron present depends on the quantity of tin chloride required to get rid of the yellow color.

One of the important duties of a mine assayer is to estimate the value of the bars of gold or silver in the possession of the company.

In the extraction of gold and silver by smelting at the mine, it is not always that impurities have been removed, and the metal ingots may contain copper, zinc and other metals. Copper ingots may contain amounts of silver; silver ingots amounts of zinc and copper. Gold ingots may contain copper, &c.

When an ingot of gold or silver is 95 per cent pure, it is termed "fine." All uncoined gold or silver or their alloys is termed "bullion." It is commonly thought that bullion refers to gold and silver coins, but this is erroneous, as the term is used only in reference to the ingots of these metals.

ASSAY OF BULLION

An assay of bullion takes the form of the assay of the ore except in assaying bullion the melting with litharge and borax is dispensed with. Small pieces of the bar are chipped out and weighed. They are then rolled out and wrapped in lead.

This is then placed in a cupel in the usual way and the silver or gold thus rendered pure. In this way, the value of the silver or gold content of the ingot is obtained.

A method of extracting pure silver from old silver watch cases, chains, &c., may be of interest to experimenters. It is based on the assay process for silver, and the writer many years ago turned into money old pieces of silver which would have been otherwise useless.

The chemicals needed are simply pure nitric acid, spirits of salts and pure zinc granules (obtainable from a chemical store).

The old silver is dissolved in nitric acid. This is easily done, but it is advisable to use a glass dish and do the job outside, as some heavy red fumes of nitrous oxide (laughing gas) are given off. These are harmless, but they smell a bit.

After about ten minutes, the silver will have dissolved and the solution will most probably be blue in color, owing to the dissolved copper used as an alloy in the silver.

Now add some water to the solution and a few drops of spirits of salts. A small quantity of common salt will do instead of spirits of salts. A thick white curd will be thrown out. Let this settle and pour off the liquid.

Add some clean water, stir, and allow to settle. Do this two or three times.

Now add a few zinc granules and some spirits of salts. As the zinc dissolves, hydrogen will be given off, and the white silver chloride will gradually turn a dark color.

When the whole mass is a blackish-grey, add some more spirits of salts to make sure that all the zinc has been dissolved. Let stand for a while and pour off the solution. You now have pure spongy silver in the dish.

Wash this several times in clean water to remove the solution of zinc chloride and dry the silver.

You can now melt up this unattractive mass of black spongy silver with a blowpipe into a glistening bead of silver which will be as near pure as no matter.

CARE WITH ACIDS!

I do not suggest that you will make a fortune this way. Silver is not as valuable as it was, but it is a very interesting experiment, and easily carried out. Keep the acids away from the kitchen, and do the job in the open.

In this way, domestic bliss will be maintained and my reputation will not be impugned or damaged in any way.

No mention has been made here of the assay of aluminium, zinc, tin and other metals. These are based on somewhat similar principles.

The primary purpose of this article has, I hope, been achieved, namely, to give some idea of the processes involved in a little-publicised but important branch of science.

HOW IT WORKS—FLUID FLYWHEEL

(Continued from Page 11)

A steady drive is given by the continual circulation of the oil as energy is rapidly conveyed from one rotor to the other.

When the driving rotor is turning very slowly the fluid circulates slowly and no drive is imparted. When the engine is speeded up the vaned disc connected to the gear box (and through it to the rear wheels) is soon turning at nearly the same speed as the driving rotor.

As the internal combustion motor of the piston type will develop a useful amount of power only at relatively high revolutions, it is necessary to gear down the engine so that it can maintain these revolutions when extra loads are imposed on it. This is normally achieved by means of the clutch and gearbox alone, but the introduction of the principle of the fluid flywheel has extended the operation by eliminating any jarring arising from the use of gears and clutch.

When a car fitted with a fluid flywheel begins to move, the slip is considerable, with the result that smooth starting without jerk is assured. When the car is moving, however, the oil pressure within the flywheel builds up, and at 30 miles an hour or more the percentage of slip is extremely low.

TWENTY YEARS FROM NOW (Continued from Page 13).

Artificial satellites such as this may solve our radio, television and lighting problems. If we "beamed" all radio to a re-transmitter on such a satellite, it would be re-broadcast so that it could be heard without interference or "fading" over a quarter of the earth. Four such transmitters would cover the whole world and make radio communication hundreds of time more efficient.

It would be even more important in the case of television, offering the one alternative to thousands of transmitters at 50-mile intervals all over the world. These projects have been seriously discussed and worked out and they may conceivably be realised in our lifetime.

Artificial lighting may come through the electrical excitation of the gases of the air. The plan would be to have a kind of manmade "northern lights" over our big cities. Instead of thousands of not very efficient street lamps, there would be a pleasant soft gentle light from the whole sky, giving, perhaps, twice the light of the full moon.

These are only some of the possibilities of rocket travel in the more immediate future. Beyond lies the incalculable possibility of flights to Venus and Mars, flights of millions of miles compared with the quarter of a million miles to the moon, but not proportionately more difficult, for once we have "conquered gravity" great distances can be covered in space with almost no expenditure of energy. I shall probably be considered very rash in suggesting that any kind of space-ship capable of reaching one of the planets may be built before the end of the next century. I shall have to console myself with the thought that I may not be alive to be laughed at or, more practically, that H. G. Wells was considered extremely optimistic when in about 1900 he gave the date 1946 as the year in which a heavier-than-air flying machine would first leave the ground.

Technical Review

R.C.A. Produces Two New Color Tubes For Television

DR. ELMER W. ENGSTROM, RCA Laboratories, explained that the elements were built into standard metal-cone tubes. He pointed out that, while the pictures measured 9in x 12in on the face of the tube, still larger pictures can be achieved; in fact, the larger the tube, the easier it is to build them for high resolution.

The images are made to appear on the face of the tube by pencil-like beams of electrons that activate fluorescent materials representative of the three primary colors—red, green and blue. Although the trio of beams all operate simultaneously down the narrow glass neck of the same picture tube, they are ingeniously controlled so that their actions are masked from interfering with the operation of each other.

The main difference between the two types of color tubes produced is that one is equipped with a single electron gun to generate the electron beam, and the other employs three guns.

COLOR OR B & W

A duo-feature is that both tubes will reproduce color pictures when color signals are broadcast, or they will reproduce the pictures in black-and-white if the signals are in monochrome. The advantages to the owner of such a flexible receiver are obvious—he can see color broadcasts, or if the transmitter is broadcasting black-and-white pictures, the color tube will also see them that way with excellent clarity and sharp contrast.

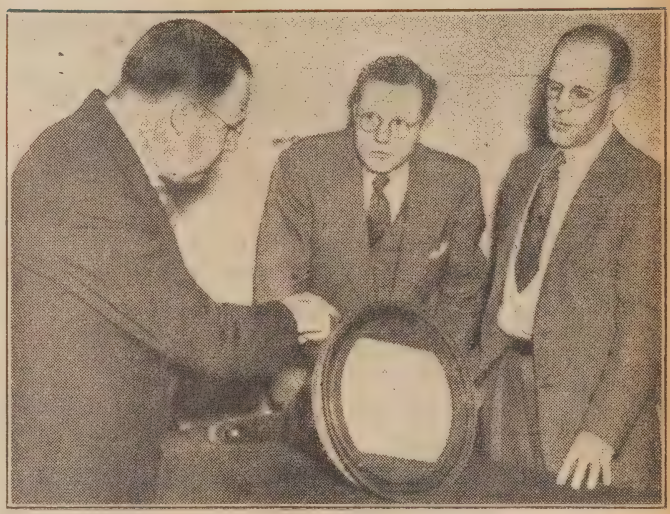
The electron guns which "fire" narrow beams of electrons at the fluorescent-coated face of the tube are controlled by the video signals as intercepted by the receiving antenna. The video signals contain the necessary information regarding the color detail of the object or scene being televised. As a simple illustration, if a rose is being televised, the video signal will carry the red information as well as the green of the stem and leaves. At the receiver, the red electron beam will handle only the red, and the green beam will be influenced only by its color. With split-second precision the two beams will "paint" the flower true to the original on the face of the tube, blending the "fluorescent paints" in perfect harmony.

To accomplish this, the face of each tube is coated on the inside with multiplicity of dots of color phosphors. These dots are arranged in triangular groups of three—one red, one green, and one blue. The total number of dots presently used on each tube face is 351,000 or 117,000 for each color. Behind the tube-face is a metal masking screen containing 117,000 holes of approximately the same size as the dots of color phosphor. The holes are so placed that they overlap equally each red, green and blue dot of a triangular group.

MASKING SCREEN

As the electron gun, or guns, scans the face of the tube, electrons pass through the masking screen and activate the color phosphor dots, causing them to give off visible light. When a video signal representing red passes through the electron gun, a red dot is activated. Green and blue dots are activated as signals representing those colors arrive.

The amount of light in color given off by each dot varies in exact accordance with the information supplied from the video signals taken from the air. This action occurs so rapidly that the light from the activated color dots blends into the natural colors of the original scene.



Harold B. Law, E. W. Herold and Russell Law with the new color tube for television.

A new color television picture tube recently demonstrated by RCA in America is hailed by president David Sarnoff as a revolutionary and epoch making invention. "We are on the threshold of a new era," he said, "the era of color."

BRAIN waves can be used by an anesthetist during an operation to warn if the patient is approaching death. According to the Mayo Clinic team at the Atlantic City (US) meeting of the AMA, continuous records of the electrical activity of the brain and heart give warning of the danger two minutes earlier than the breathing and pulse rates which the anesthetist ordinarily observes.

A machine standing at one side of the anesthetist takes continuous records of the patient's heart and brain waveforms. When the rectangular waves suddenly flatten out almost to a straight line, it is time to stop the anesthetic mixture and turn on the oxygen.

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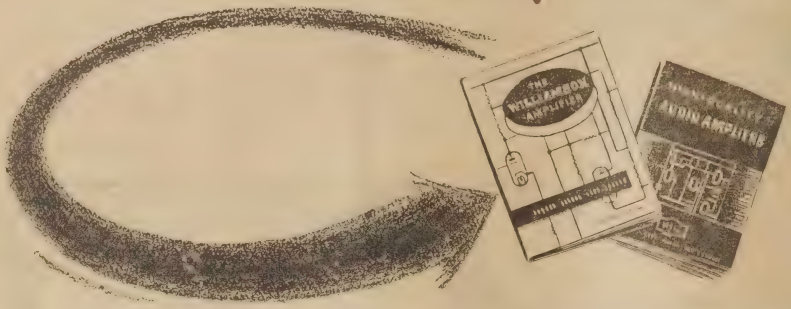

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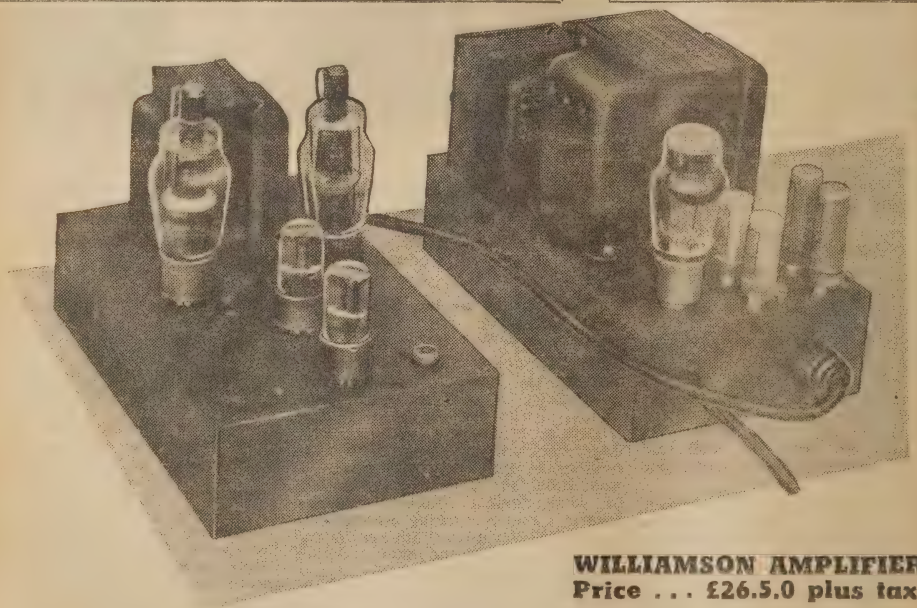

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DESIGN OF UNDERGROUND SPEAKERS

Josef Merhaut, writing in Tesla Technical Reports examines the rather unusual subject of underground loudspeakers. He rejects certain arrangements and suggests one which has been proven by tests in the Strahov Arena in Prague.

THE need for underground speakers is explained by the fact that up to 190 metres may separate individual rows of gymnasts in a large arena, producing a time lag of nearly a three-quarter second, before the sound can reach the more distant performers from any point outside the arena.

This delay produces a wave-like motion in a mass display which greatly detracts from the spectacle.

Multiple speakers outside the arena cut the time lag, but produce troublesome echo effects and also treat the spectators to a confused pattern of sound intended mainly for those inside the arena.

Since it is generally undesirable to erect posts in the arena, carrying overhead speakers, attention has been given to the problem of placing speakers underground, and a number of systems have been tried in various European stadiums.

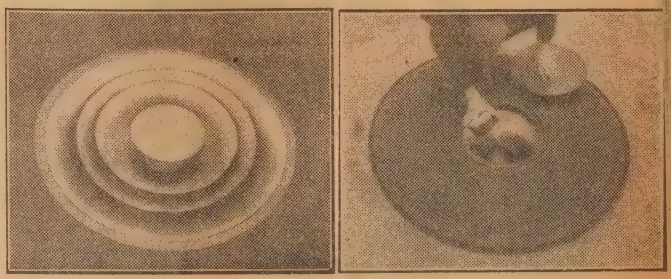
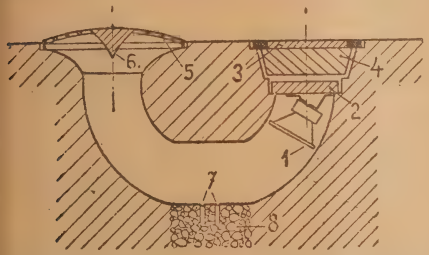
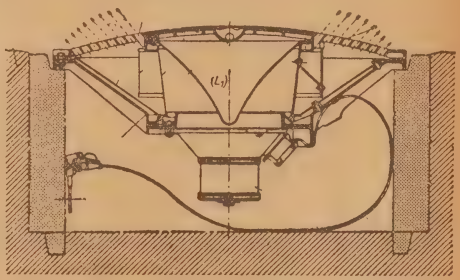


Figure 5, on the left, shows the diffusing vanes in the mouth of the horn. Figure 6 (right) shows the heavy cover in place and a smaller cover for ready access to the motor unit.





Figures 1, above, and 2, on the right, show schemes which have proved unsatisfactory due to the effect of dampness on both the cone and the metallic structure.

One used standard speakers in U-shaped underground tubes, as in figure 1. The speaker is protected against direct spray, but it was found that dampness soon affected the cone material and also penetrated the magnet structure and winding.

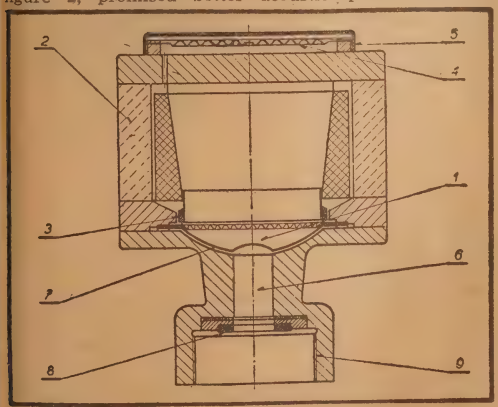
A variation of the scheme, as in figure 2, promised better acoustic efficiency, but also suffered from water and dampness. It proved necessary to collect the speakers on a motor truck after each performance and replace them when subsequently required.

A satisfactory solution was found in the system illustrated by figures 3-6. The motor unit is similar to a conventional PA unit but specially proofed against moisture. The unit is completely self-sealed with a synthetic diaphragm (7) and a metallic pressure relief diaphragm (4) at the rear.

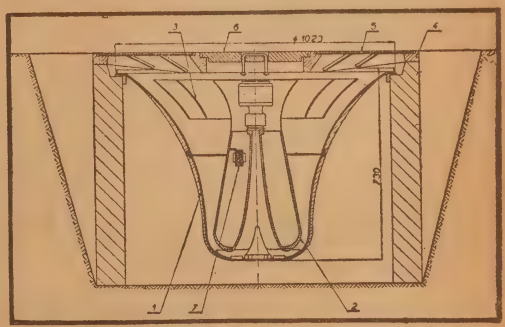
No leads are employed external to the unit, electrical contact being established by the flange and an insulated ring (8) which operates when the unit is screwed to the horn assembly.

This latter is an exponential re-entrant type made from thin metal and tar-covered to give added protection and acoustic damping.

The mouth of the horn contains diffuser vanes (figure 5), whose action is assisted by additional vanes under the heavy covering grille (figure 6). This is sufficiently strong to withstand the full weight of a water-sprinkling truck, the water being drained out of the assembly, together with dust, by suitably placed holes.



The basic loudspeaker unit, which is completely sealed against moisture.



Cross section of the re-entrant horn, with diffusing vanes. acoustic efficiency is between 35 and 40 per cent.

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MODEL 47A-P
MUTUAL CONDUCTANCE VALVE AND MULTITESTER

Fitted with large direct reading meter with illuminated dial and OVERLOAD PROTECTION. Tests over 2000 American English and Continental valves including latest types. Filament volts range from 1.1 volts to 117 volts. Filament continuity and element shorts shown directly on meter. Cathode leakage read in megohms. The instrument is housed in a solid oak carrying case and supplied with comprehensive instruction manual. Also available as valve tester minus multitester ranges—Model 45 A-S.

MULTITESTER RANGES. 1000 ohms per volt A.C.-D.C.

D.C. Volts	D.C. Current	A.C. Volts	Resistance
0-120 m.V.	0-0.6 mA	0-3	0.5-22.5-1000 ohms.
0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 Megohms.
0-300	0-1.5 Amps	0-600	x with external battery.
0-600			

PRICE £39/17/6 Plus sales tax.

IMMEDIATE DELIVERY

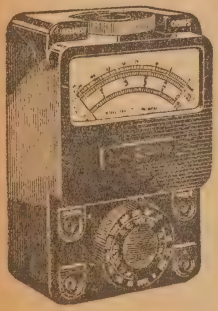
MODEL 75A

RANGES 20,000 ohms per volt A.C.—D.C.

D.C. Volts	A.C. Volts	A.C.-D.C. Current	Decibels	Resistance
0—0.1	0—1	0—50 uA	—30 to —5	1—50—10,000 ohms
0—2.5	0—2.5	0—5 mA	—22 to +3	1000—50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

PRICE £19/15/- Plus sales tax.



MODEL 120A POCKET MULTIMETER

RANGES 1000 ohms per volt A.C.—D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	*With external battery.
0—2500			

This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

PRICE £9/17/6 Plus sales tax.
DIMENSIONS: 4¼" x 3½" x 2"

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Queensland: CHANDLERS PTY. LTD., Cnr. Albert & Charlotte Sts., Brisbane.
Victoria: J. H. MAGRATH & CO., 208 Little Lonsdale St., Melbourne.
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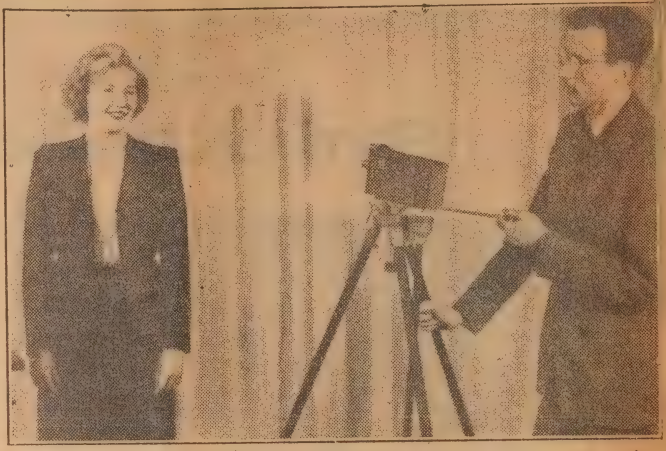
Taylor Best for TEST EQUIPMENT

Manufactured by:—TAYLOR ELECTRICAL INSTRUMENTS LTD., GREAT BRITAIN

NEW VIDICON TUBE FOR COMPACT TELEVISION

Main Application For Industrial Television

Television systems for industrial use where efficient and compact apparatus is required are possible by using the new RCA Vidicon tube in a miniature camera.



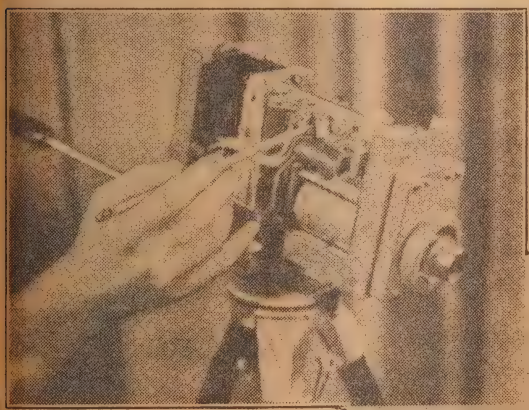
Smaller television cameras, ideal for industrial and educational uses, are made possible by a diminutive pick-up tube called the vidicon.

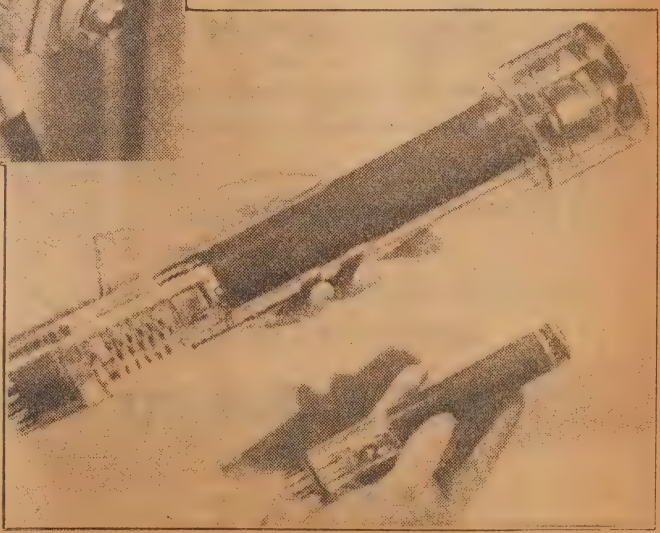
THE Vidicon tube, which measures only 1in in diameter and 6in in length, represents a departure in pickup tube design, in that it operates on the principle of photoconductivity, while the image orthicon and other current pickup tubes in general use employ photoemissive cells. Ordinary 16mm motion picture lenses, which are comparatively reasonable in cost, work satisfactorily with the 1in Vidicon.

The system is capable of transmitting a signal 500ft over a coaxial cable closed circuit, giving it enormous flexibility for a wide range of industrial applications. It has a scanning frequency of 525 lines, 60 frames interlaced, and is almost compatible with standard television broadcasting techniques. Home television receivers can be adapted for use as monitors by the addition of a single tube, with accompanying resistors and capacitors, at a very modest cost.

The master control unit of the system is 24in long, 15in high, and 8¾in wide, and weighs 58lb. It contains a regulated power supply, small synchronising signal generator, a video amplifier strip, and all the scanning deflection equipment for both the camera and its own 7in monitoring kinescope. It contains 44 tubes—about 50 per cent more than the average home television receiver and operates on 110-volt, 60-cycle power lines. The entire power consumed by the system is less than one-third of that required by an electric toaster.

The camera is 10in long, 3¼in wide, and 5in high. It has a remote focusing mount, which permits the operator to adjust optical focus by remote control from the master unit.





Left: Interior of small camera showing the vidicon tube at the lower right corner of the case. Below: A comparison of the relative sizes of the standard image orthicon camera tube and the newly developed vidicon.

CRYSTAL TOLERANCE

US National Bureau of Standards has developed a method of lapping quartz crystals to a 0.001 inch thickness with satisfactory flatness and parallelism. Two variations of the square block and cell method can be used. Crystal is held to plunger by oil and then placed on lapping stone, confining crystal between piston and plate by cylinder walls.

TURBINE ADDS 550 H.P. TO ENGINE

In these days when so much interest is centred on the jet power plant it should be remembered that highly successful work is being done to improve the efficiency of the standard piston engine.

RELEASE of technical details of the new compound engine powering the Lockheed P2V Neptune patrol plane calls further attention today to the US Navy's latest anti-submarine weapon. Aviation publications in the US currently report operation of the new Wright Turbo-Cyclone engine which converts waste exhaust gas into extra engine power.

According to the US military publication *Armed Force*, this is the first and only compound engine to pass a military acceptance test, first to go into quantity production and first to be flown in a production airplane.

Aviation Week reports the Wright engine brings "into sharp focus" once again the entire subject of aircraft range. For the Lockheed Neptune with the new compound engines, the magazine estimates an increased range of more than 2000 miles. This aircraft already holds the world's record for long-distance, non-refueled flight, established in 1946 when the US Navy's Truculent Turtle flew from Perth, Australia, to Columbus, Ohio.

NEPTUNE'S FLIGHT

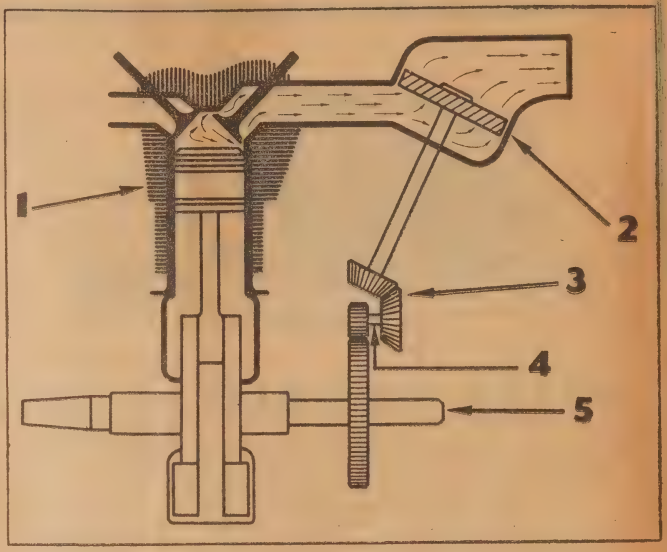
First flight of any airplane powered by compound engines was made by the Neptune, and future production models of this airplane will have the new engine.

Manufactured by the Wright Aeronautical Corporation, the compound engine provides twenty per cent extra power by converting waste exhaust gases into energy. This further extends the range and/or speed of the aircraft.

Armed Force magazine describes the principle of the compound engine and illustrates its operation:—

"Exhaust gas from the cylinders of the reciprocating engine is piped directly into turbines instead of exhausting into the air. By recovering this usually wasted energy in the exhaust, the turbines produce a large amount of power without any additional fuel. The power thus generated is fed back to the crankshaft and eventually to the propeller through a series of gears and fluid couplings similar to those in automatic automobile transmissions.

"The new turbo-cyclone 18 compound engine generates 3250 horsepower. Its main reciprocating unit is rated at 2700 horsepower. The extra 550 horsepower is generated by the three gas turbines being turned by exhaust gases."



How the engine operates. Exhaust gas from the cylinder (1) flows through the exhaust pipe in which is mounted the turbine (2). Extra power is thus fed through the gears and coupling (3) and (4), back to the crankshaft (5).

This drawing shows in simplified form the operation of the new compound engine installed in the P2V Neptune. First, the exhaust gas from the cylinder of a conventional piston type engine (1) is piped to a small gas turbine. The exhaust gas causes the turbine wheel (2) to spin, and the power generated is fed through a pair of mating bevel gears (3), a fluid coupling (4) and a pair of straight gears directly to the crankshaft or main shaft (5) of the basic piston engine.

PHOTO-CELL TEMPERATURE INDICATOR

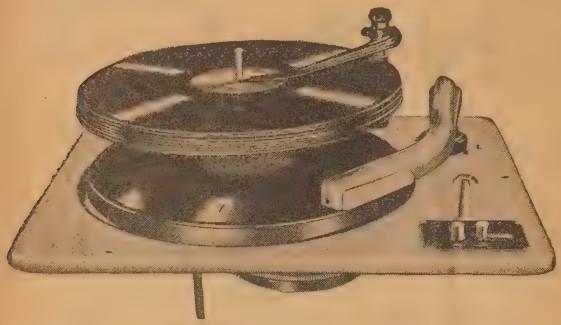
OPTICS have now been applied to the measurement of color temperature. It is a well-known theoretical fact that, with certain reservations, the color of a heated substance (its color temperature) is closely related to its true temperature. Equally well known is the fact that photo-electric cells can be made to react differently to various types of colored light. Color temperature—sufficiently accurate for many practical purposes—should therefore be measurable by ascertaining in a given color mixture the proportion of two components.

This rather complex reasoning is given a straightforward practical form in a meter produced by the London, England, firm, Megatron Ltd. The device, a compact, self-contained cylinder, measuring 3.5in by 2.5in (8.7 cm by 6.3 cm) and weighing 21oz (0.6 kg), works as follows. Two filters, one red, one blue, and each containing a photo-electric cell, operate in conjunction with a shutter.

First, the red glass is entirely exposed, the blue totally covered. The instrument is held near the eye, and the light source sighted through a hole in the dial. The observer now moves backwards and forwards until a position is reached at which the pointer on the meter reaches the maximum.

The shutter is next rotated until the pointer coincides with a hair-line visible through the hole. The color temperature is read off on the meter in degrees Kelvin (this scale, based on absolute zero of —270 deg. C., can be converted to Centigrade by subtracting 273). A slightly different technique is used with exceedingly bright lights.

two of the best . . .



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2. Plays nine records, either 10" or 12" as selected.
3. Amazingly quick and easy . . . to load . . . to play singles . . . to reject . . . to unload . . . to stop,
4. Crystal or high fidelity moving pick-up
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EI/2655

NEWS AND VIEWS OF THE MONTH

Super Radar

LONDON airport is now equipped with the most up-to-date long-range radar aids, which can "see" airliners 130 miles from the airport.

This £125,000 radar "eye" gives ground controllers a complete picture —on their radar screens—of all planes in the crowded air around London.

They can guide aircraft safely in all weather along the approach lanes to London's several airports before finally handing them over to GCA—the famous Ground Controlled Approach system—to be talked down to their final landing.

The equipment weighs 60 tons and contains 1000 valves.

It stands on a hill about a mile from London airport control tower, and includes what looks like a horizontal windmill.

This is the scanner, which revolves four times each minute and picks up flying objects on its radar beams.

The scanner is linked to eight radar sets.

★ ★ ★

Homebuilders

The advent of television may well open up new fields for the home constructor. This "species" shows a vastly improved technical and mechanical ability over the past few years, as our mailbag eloquently bears testimony. It is unlikely that high-priced receivers will descend on the country in a flood for some time after television is introduced, and the fascination of making something new, and probably saving money, is bound to attract many home builders.

The cost of a television receiver is made up by the price of many parts, but also of at least an equal value in labor. It may be that the gap between the cost of a home-built set and a manufactured set will be considerable. The radio trade would do well to foster home building. Every set in operation is a salesman for others to people who can't build, just as in the early days of radio, the set built by the amateur was the inspiration to many others to spend their money on factory-made sets.

★ ★ ★

Our Broadcasting

AUSTRALIA must surely stand high in the world in the coverage of its broadcasting services.

We note that the latest figures released on broadcasting licences has now passed the total of two million. If we add to this figure an unknown number of sets which are n licensed, and we regret to say th if we are realistic we must do we would have a large figure again a total population of about eight mi lion, most of whom, of course, c never be individual owners.

So much for the listeners' ang When we have a look at the tran mission side, we find that we ha something like 150 stations operati or planned for the broadcast ba Of this number, only about a doz are not yet in operation. We ha also various short wave services, t function of which is to cover are where the longer wave stations gi poor or doubtful coverage in t outback.

Behind all this we have a lar manufacturing industry, able to pr duce radio and communication equi ment of all kinds, of a quality equa to the world's best, and speciall designed to suit our conditions.

Altogether, it is a healthy pictur not only for the present, but for th future.

RADIO CROSSWORD PUZZLE, No. 35

ACROSS

1. Coherer type of detector.
4. Type of oscillator.
9. Relating to vision.
10. High-ratio transformer.
11. Bearings from radio range.
12. Daughter of a brother.
13. Invisible particles.
16. Unit of flux density.
20. Negative ion.
21. Sudden current change.
24. Student in academy.
25. Sound absorbing material.
26. Those defeated.
27. One who transmits.

DOWN

1. Increases power.
2. Active.
3. French public school.
5. Aerial.
6. Tryers.
7. Tool for enlarging holes.
8. Telescope.
14. Three-element valves.
15. Modulation meter.
17. Unit of luminous intensity.
18. Two-element valve.
19. For measuring high resistances.
22. Anode.
23. Landlord.

BELOW—LAST MONTH'S SOLUTION

S	O	C	K	E	T		T	E	S	T	E	R
C		A		A				M		U		A
R	O	T	O	R	S		T	I	N	N	E	D
E		I		S	E	T		T		E		I
E	B	O	N		L		T		E	R	G	O
N		N		D	E	T	E	C	T	S		S
			V		C		T		A			
M		B	A	T	T	E	R	Y		F		G
E	X	I	T		S		O		H	O	U	R
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R	A	D	I	U	M		E	D	I	S	O	N
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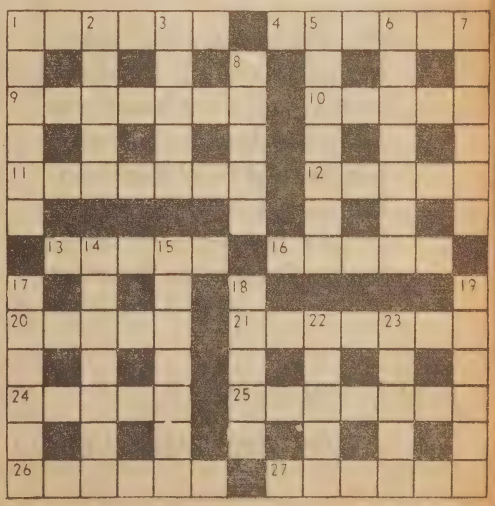

Too Much Speed

ONE highly interesting lesson learned from the conflict in Korea has been that the American Shooting Star jet fighters have been of much less value than the air-screw-fitted Mustang, which, of course, has a much lower maximum speed.

The story is that the Stars are just too fast to cope with ground contact work, and although so far little aerial combat has been seen, it is quite probable that much the same result would be observed.

In other words, it's not much use stepping up speed past a certain point unless other factors are scaled up to suit. It seems logical to assume that no fighter aircraft is of much use if its demands are beyond the physical limitations of the pilot. Not only do these include the tendency to black-out but also sheer ability to sight the target at high speed, and approach safely within striking distance.

Until or unless we can have a single aircraft which can combine great speed with the ability to mix it at slower speeds, it looks as though the really fast aircraft will be valuable mainly for interception and not for dog-fights.

Push-button Tuning

SOME of the best ideas in radio often fall by the wayside, or at least are not adopted as widely as they should be.

The push-button tuner is very near this category, although overseas we see it much more frequently than in Australia.

Logically, if we admit that the average person listens nearly all his time to local stations, there is not much use in providing a tuning dial which has to be spun backwards and forwards, having the dubious advantage that, with its aid, some interstate or more distant stations can be located, weather permitting, and if the interference from some unwanted programme allows.

One would imagine that a receiver which has a number of buttons conveniently placed, each giving a local station when pressed, would be just about the ultimate in station selecting, particularly if a simple relay or motor drive added the convenience of remote control.

It is interesting therefore to note that one of our coil manufacturers is sounding out the market for a new push button tuner. The idea seems to be fine in principle, although there are one or two little snags—the danger of too much oscillator drift being one—which so far has proved an obstacle. Maybe with a newer and perhaps better approach, it might be possible to do a better job today.

Credit to Amateurs

ANOTHER word of commendation to NSW amateurs who did such a fine job in the Hunter Valley, once again laid waste by flood. Conferences are taking place between the police, the Services and representatives of the WIA in an endeavor to render still better service if the need should arise.

A NEW APPROACH TO HIGH-

Continuing his discussion of wide range radio receiver design, our contributor evolves a new filter type tuning system with controllable bandwidth. A push-pull detector system is also suggested. While necessarily more complicated than conventional T.R.F. circuitry, the ideas of Mr. Hosken will be of special interest to designers and advanced experimenters.

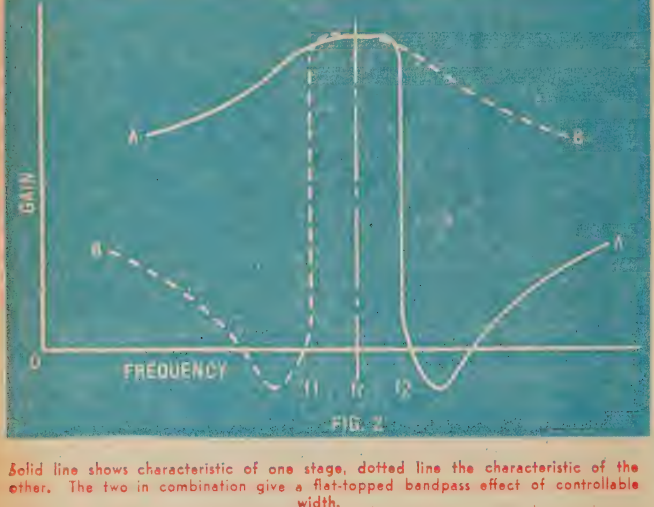

FIG. 2.

Solid line shows characteristic of one stage, dotted line the characteristic of the other. The two in combination give a flat-topped bandpass effect of controllable width.

THE problem resolves itself into one in which the pendulum action must be under control to ensure adequate band-width without destroying sensitivity or selectivity. The author's approach to a solution is through VARIABLE (Q), derived from a variable impedance valve "generator" connected in series with a series resonant circuit.

As a first step, a series tuned circuit is connected to the cathode of a valve (see L1.C1 in Fig. 1). A d-c path is provided by an RF choke. This is a 7mH type, wound in six sections of graded dimensions, the small section end being connected toward the active RF potentials.

BY-PASS CONDENSERS

Relatively large bypass condensers are required, and connected respectively by short conductors, between plate and earth and between screen and earth, to complete the overall series circuit.

The action of this series circuit is as follows—

When switched "On," but not receiving a resonant carrier and resultant RF grid volts, the valve offers very high RF impedance in series with the tuned circuits. It is practically open circuited, and noise level, if any, is extremely low, which is ideal when tuning between carriers.

On receipt of a strong atmospheric the valve impedance may momentarily be lowered, but it immediately rises again to open the circuit. The pulse time is not extended, as in the case of the pendulum action in a closed parallel circuit.

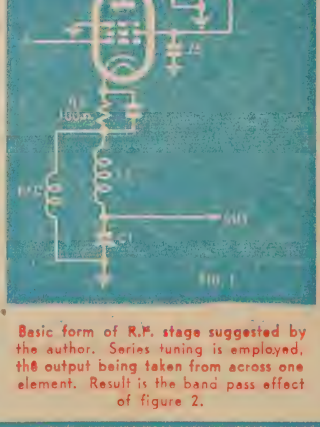
FIG. 1

Basic form of R.F. stage suggested by the author. Series tuning is employed, the output being taken from across one element. Result is the band pass effect of figure 2.

With an RF signal impressed on the grid, the valve can be regarded as a cathode follower, characterised by good linearity, a high grid input impedance and a low output impedance from the cathode circuit.

This low output impedance means, in turn, a substantial increase in the "Q" of the tuned circuit, which is essential to its subsequent function as portion of a band-pass filter. However, the cathode follower action holds good only for signals actually impressed on the grid.

Thus, a noise transient is repeated faithfully in the cathode circuit but, the moment the transient is removed from the grid, the cathode follower action ceases. The tendency for the tuned circuit to continue oscillating is defeated by the fact that the normal high plate resistance of the tube is in series with the resonant components. Thus, in practice, atmospheric noise impulses sound rather like drops of water falling on a hot plate.

Gain is derived from the circuit by virtue of the magnification of the coil. Although the series impedance may be low at resonance the voltages developed across the terminals of either reactance can be relatively high. The output voltage is thus taken from the terminals of one reactor which is at the earthy end of the series. In this case it is the tuning condenser.

The output response characteristic from this device is not symmetrical—it follows the general shape shown by the heavy line curve in Fig. 2.

By transposing the reactors the output characteristic is reversed, as shown by the broken line curve.

COMBINED CHARACTERISTIC

Both series circuits are acceptor type, and it is easy to see that if the output characteristic is reversed, as superimposed on that of the other, as shown in Fig. 2, it would result in a band-acceptor. This may be effected by connecting the two types in cascade. (See (A) stage and (B) stage in Fig. 3.)

In one stage the short cut-off shown at the bottom of the graph near resonance will severely attenuate a respective upper characteristic of the adjoining stage, and vice versa.

The final output from the band-acceptor would resemble the composite curve between f1 and f2. Resonance is denoted by fr.

It is easily seen, too, that the bandwidth is adjustable by a small reduc-

FIDELITY RADIO RECEPTION

tion in the capacitance of C1 in (A) stage to increase its reactance and shift the heavy line curve to the right. Similarly a small increase in C2 of (B) stage will reduce its reactance and shift the broken line curve to the left. The band-width will thus be wider.

CORRECT ADJUSTMENT

And, incidentally, when these latter adjustments are performed correctly the band-acceptor is in its most stable condition. Band - width governs cathode impedance. Further gain may be derived by adding another band-acceptor.

The band-acceptor is ideally suited to direct coupling. It will be seen that the output of (A) stage is taken direct from the junction of L1.C1 to the grid of (B) stage.

This connection will also carry with it the positive d-c volts from (A) cathode via L1 to (B) grid. Consequently the bias resistor R2 of (B) stage must exceed twice R1 of (A) stage to provide its own bias, cancel the positive volts from (A) cathode, and make up the difference because the internal resistance of RFC1 is not doubled in RFC2. All RF chokes are alike. If R1 is 100 ohms, then R2 should approximate 250 ohms.

The tuning condenser C2 blocks the d-c volts of (B) stage from being applied to a succeeding grid. Any additional band-acceptor will therefore have the same relative quantities in its bias resistors as R1 and R2 of the first band-acceptor. Grid suppressing resistors R3 and R4 are desirable when high trans-conductance valves are used. A tuning indicator is desirable as an aid to correct tuning.

Beyond the short cut-off frequencies which determine the band-width of the band-acceptor (see Fig. 2) the lower characteristics rise again at some distance from the band, and it is necessary to render them ineffective by employing a pass-band preselector, preferably of the two-circuit type, and capacity coupled at the earthy end of the inductances L3.L4, as shown in Fig. 3.

An RF choke is connected in parallel with the coupling capacitor C5 to complete the metallic circuit between grid and earth.

AERIAL COUPLING

Aerial input gain may be improved without destroying selectivity by making the aerial circuit series resonant. Most aerials used for the medium frequency B/cast band look capacitive, and resonance is effected by adding a loading inductance L5 in series with the aerial. The inductance L5 should be of solenoid form to minimise distributed capacitance.

By employing a small coupling capacitance of only one or two Pf. between L5 and the active end of the first tuned circuit in the preselector, tracking of ganged circuits is practically unaffected by the aerial.

In practice, it is not essential to re-tune the aerial each time the receiver tuning is changed. If L5 is made maximum for the high frequency end of the B'cast band it should suffice for the entire band.

The band-acceptor employs only one tuned circuit per stage and eliminates the intermodulation problems which may arise from RF transformers. Circuits and circuit alignments are simplified. All tuning condensers have trimming condensers for ganging alignment. No difficulty is experienced in the alignment of each stage of the band-acceptor because there is no sharp cut-off between tuning points and resonance, provided that C1 is less and C2 is greater than the requirements for resonance.

RF gain is controlled by adjusting the screen volts with a potentiometer. AVC is not essential with a local station receiver, and no provision is made to include it. A diode should, however, be provided in the receiver to control a tuning indicator, which is also useful when aligning the circuits.

The very low noise experienced when tuning between carriers is an ideal feature, during alignment adjustments.

Some readers might be dismayed at the idea of attempting the construction of a complete RF amplifier consisting of a preselector and one or two band-acceptors which respectively require one and two insulated variable condensers, so that their moving plates may be connected to cathode. However, the task is not a formidable one.

The first three condensers, C3.C4 of the preselector and C1 of (A) stage in the band-acceptor are all earthed and may conveniently be a three-gang variable.

C2 of (B) stage is a single gang and insulated from earth. There are occasions when a second band-acceptor would be desirable, and it is recommended that provision be made for its installation at any time.

The second band-acceptor would require two single gang condensers for the additional C1.C2. C1 is earthed, and C2 insulated.

Their relative positions, and a method adopted to drive them, are suggested in Fig. 4. An extension shaft, attached to the three gang, has three driving drums fitted.

The shaft is a direct drive to the three gang variable. The single gangs having drums fitted to their shafts are driven by the drums on the main shaft. All drums are equal in diameter. So much for the RF amplifier stages.

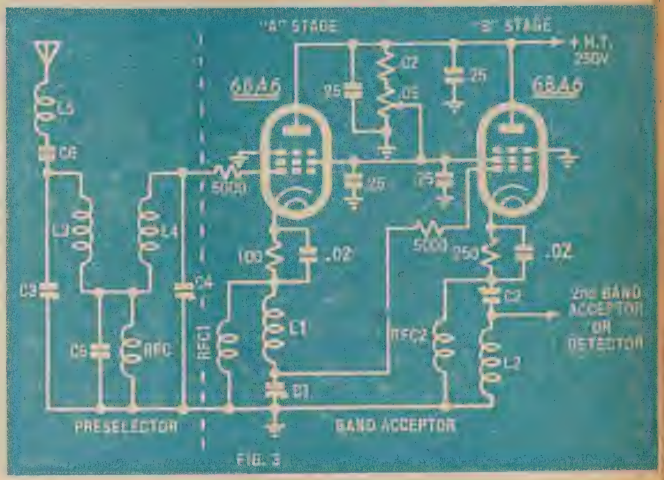

FIG. 3

A complete "band acceptor" involving two R.F. amplifier valves with series tuned circuits. A band pass tuner is added for the aerial circuit to ensure discrimination against signals well removed from the wanted carrier.

by S. V. Hosken

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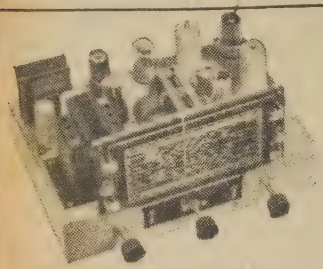

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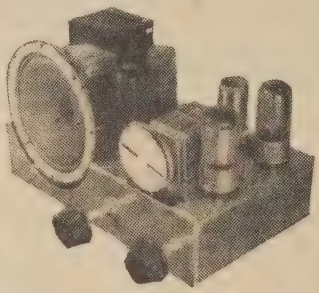

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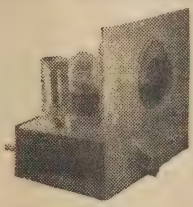

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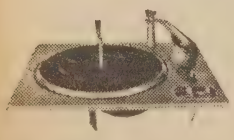

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The functions of a detector are: (1) to demodulate a modulated carrier by a process of rectification of oscillating currents. (2) To filter out the RF component after rectification. (3) To respond to the audio frequency component of modulation. (4) To have linear gain characteristics. (5) To be efficient. (6) To possess 100 per cent modulation capability. (7) Its input load should not be excessive. (8) It must operate another circuit to which the output is coupled without detrimental effect on the operation of the detector itself.

CLOSE TOLERANCES

Because of its complex functions, the optimum operating condition of a detector is limited to close tolerances.

It has been shown that the process of modulation varies the amplitude of oscillating currents in sympathy with the wave forms of speech and music. The subsequent rectified d-c will also vary in the same order.

To enable this rectified d-c to develop voltages, a resistance (R) must be added in series with the rectifier, and a potential drop appears across the terminals of R. (See fig. 5).

An R.F. bypass or filter condenser (C) is connected in shunt across R. This condenser must possess a low reactance at R.F., but high reactance to A.F. Hence C must be able to change its charge with the rapidity at which the d-c varies with modulation, when d-c amplitude falls with modulation C should discharge through R at a rate equivalent to the highest audio frequencies. This rate depends on the cycle-equivalent of the CR time constant. The CR time constant is conveniently found by the product of C in microfarads, and R in megohms.

It is not equivalent to the complete discharge of C, but rather to the time in fractions of a second which elapses while R discharges a condenser C by 0.632 or 63.2 per cent of its initial charge. The current flow follows a similar characteristic and also falls by 63.2 per cent from its initial strength, leaving only 36.8 per cent.

Alternatively, these factors may be related to the charging of C.

The quantity 0.632 may be considered as equivalent to (2/pi) which is the "average" quantity in a sine wave. The maximum quantity in a sine wave is attained in a quarter of a cycle from zero, and is equal to (pi/2) times the "average" (2/pi); hence max is (pi/2) times (CR), and equals (pi/2x CR). It is also equal to (pi/2 x 2/pi) equals ONE charge of (C), (or one discharge).

UPPER FREQUENCY

A complete cycle of four quarters, equals (4) times (pi/2 x CR) equals (2/pi.CR) time constants in fractions of a second. Hence the complete cycle takes (2/pi) times longer than (CR to complete two reverse changes, and two reverse discharges, or a total of four in all. And since there are 2/pi radians per cycle, the (CR) time constant is equivalent to an effect produced in one radian.

Frequency is found by dividing (2 pi CR) into unity, thus:

Frequency equals 1/2 pi CR.

Where (C) is in microfarads,

(R) is in megohms.

R is usually fixed by circuit conditions, and the problem resolves itself to finding the maximum permissible value for C. Transposing we have:

C equals (1/2 pi FR).

When a pi network R.F. filter is employed in the detector output circuit, a series R.F. choke has input-and-output condensers, connected like the filter circuit of a power supply. The R.F. choke offers high reactance at R.F. but negligible reactance at A.F. The input and output condensers are therefore effectively in parallel at A.F.

The expression (1/2 pi CR) represents the highest audio frequency beyond which higher notes would be attenuated.

CONSIDERABLE LOSS

It will be seen that when the C and R of grid leaks-and-condensers or their equivalents in other types of detector, are calculated directly in terms of the CR time constant, instead of from its equivalent of a cycle, there would be (2 pi) times difference in their quantities, an high note loss may ensure.

The characteristic slope of detector is derived from the magnitudes of its rectified currents relativ to input volts. This determine detector efficiency.

The slope should therefore b steep, and linear. Any curvature i the characteristic will introduc harmonic distortion and possibl A.F. intermodulation.

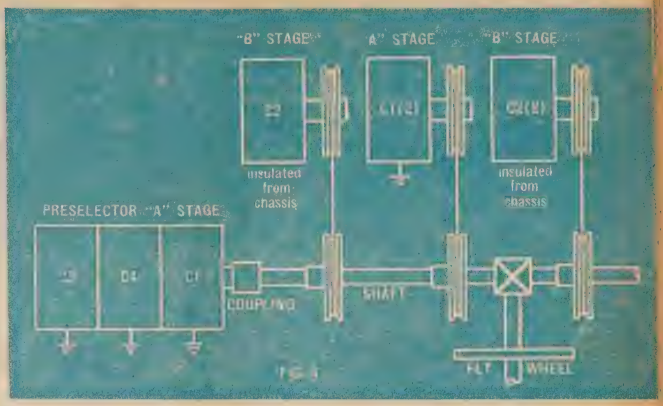
Detector characteristics can exer considerable influence over th acoustic quality of audio output They may unbalance the powe ratios in high and low notes an cause listeners to twiddle with ton controls subconsciously seeking a acoustic balance.

The rectified current changes ar the result of modulatioin and vary as the slope. If the slope is only gradual then the detector efficiency is low and there would be very little change in detector output for each one db gain applied to the depth of modulation. The output may be less than 0.2 db per one db input gain whereas, with a steep slope, it could exceed 0.8 db and the audio output would be greater.

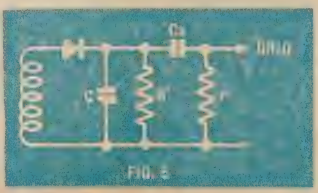
There is an optimum d-c load R to match each rectifier. The d-c load also presents the optimum a-c load on the detector. If the a-c load is increased when another circuit is added to the output of the detector, the a-c load exceeds the optimum, the slope will be less steep and the modulatiion capability of the detector will be curtailed.

The modulation capability of a detector, relative to 100 per cent modulation of a carrier, is determined from the ratio of its a-c loading, to its d-c load R, and it has been shown that this ratio should be as near as possible to ONE-TO-ONE or unity.

The d-c load, which is the added diode load resistance R in series with the rectifier, is limited to one branch of a two branch circuit. The a-c load consists of both branches, R and r in parallel, assuming negli-



A suggested method of driving the tuning condensers in a double band-accepter tuner. The author claims that the results justify the extra complication involved.



Illustrating the basic circuit for a diode detector, together with the output coupling. Values are discussed in the text.

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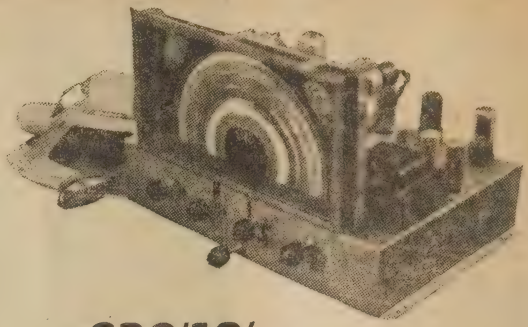

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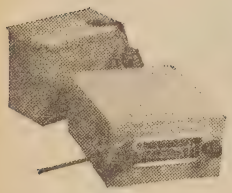

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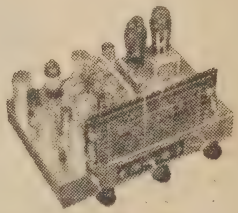

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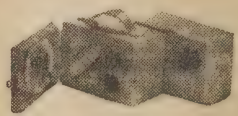

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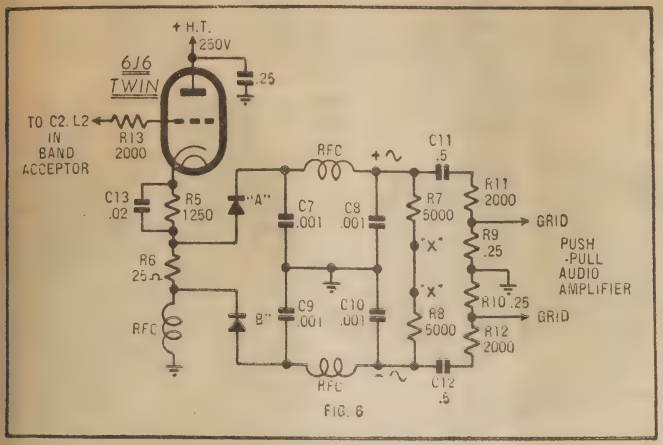

FIG. 6

The complete detector circuit which, it is suggested, should be used with the band-acceptor tuner. It delivers push-pull output to feed the grids of an overall push-pull amplifier.

gible effect of the coupling condenser, Ca. (See FIG. 5).

The a-c load is the reciprocal of (1/R plus I/r). This calculation may be simplified, thus:

$$\text{a-c load equals } \frac{R \times r}{R \text{ plus } r}$$

As simple example, assume the diode d-c load R to be 6 Ohms; and the coupled circuit load, which may be a grid leak in the next stage, to be 12 ohms.

The modulation capability being approximately equal to the Ratio of a-c to d-c loads would be 4/6, equals 66 per cent.

LINEARITY

This simply means that the characteristic slope would not be linear when the depth of modulation exceeds the approximate amount of 66 per cent.

It further shows that the resistance of a succeeding grid leak should be many times the quantity in the diode resistor R to maintain a high degree of modulation capability, and minimise distortion.

To avoid any possibility of grid current effects upsetting valve operation, I personally prefer to restrict grid resistors to about 0.25 meg.

Therefore diodes, and diode load resistors, must be of low resistance. By employing 250 ohm germanium crystals, an R valve of 5K ohms and an (r) of 250K ohms, then (r) is 50 times (R) and the modulation capability would approximate 98 per cent.

A further point is that, although two sidebands are transmitted by the amplitude modulatiion system, the current mode of detection rectifies only one sideband and 50 per cent of the available sideband power is not profitably used.

The modulation characteristics of both sidebands determine the shape and symmetry of the carrier envelope. Because of considerations in the design of receiver components, curvature in R.F. valve characteristics, and mistuning of the average receiver, it is reasonable that collectively these factors will effectively change the shape and mar the symmetry of the carrier envelope.

Consequently, the modulation characteristics in any one sideband would differ from those in its opposite sideband as well as from the original. The quality of audio output would subsequently be influenced by the choice of sideband selected for rectification by the detector.

On the other hand, if both sidebands were simultaneously demodulated, their algebraic sums should be conducive to higher degrees of detector efficiency, fidelity, and signal noise ratio. For any given strength of modulated carrier, the audio output would be approximately doubled. And furthermore, the more linear its characteristics, the higher would be the degree of selectivity.

In order to gain these several advantages, in addition to the elimination of phase inverters, and loading imposed by the application of positive bias, the author developed the following comprehensive high efficiency "salient" detector.

The salient detector demodulates both sidebands. FIG. (7) shows that the detector forms a salient to the cathode circuit of a class "A" R.F. triode. This arrangement also matches the relatively low input impedance of the detector.

The cathode circuit includes a triode bias resistor R5, shunted by C13, a diode bias resistor R6, and a 7mH R.F. choke of type previously described.

The salient consists of two germanium crystal diodes type B.T.H. C.G. I-C, which should if possible be selected in equally matched pairs, then two pi network R.F. filters and

(Continued on Page 102.)

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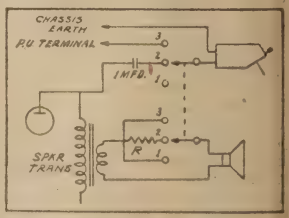

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PUTTING YOUR C.R.O. TO WORK

It can be assumed that the reader is now familiar with the test set-up required to view waveform patterns and the equivalent input/output linearity trace. In this article, with the aid of curves and photographs, we attempt to correlate C R O patterns and valve characteristics.

By W. N. WILLIAMS

AS a basis for discussion, it may be as well to refer to the curves f a particular valve and the triode-onnected 6J7-G is as good as any.

Figure 1 shows the manufacturer's late family of curves in which late current is plotted against plate oltage from various values of grid ias.

If the valve is operated with a late load of .05 megohm and a late supply voltage of 300, the oad line will be as shown. Its xact slope and position would be odified in practice by the effect f a following grid resistor but we hall choose to ignore this as a econdary consideration. It does not ffect the course of the discussion.

When the valve is in operation, nd an incoming signal swings the rid about its centre value, the nstantaneous plate voltage and cur-ent swings to various points along he load line. For example, if the nstantaneous grid voltage happened o be —10, the instantaneous plate oltage would be about 226 and he plate current about 1.6 milliamps.

YPICAL FIGURES

At another point on the cycle, the rid voltage may be —5.0, giving plate voltage of 159 and a plate urrent of 3.5 milliamps.

For a power valve, the method of rawing in a load line is somewhat ifferent in detail, but the same bservations can be made.

By reading off values from this urve, it is possible to plot the ignal input voltage to a stage against the signal output voltage, for a specific set of operating conditions. The signal output can be expressed either in volts or milliamps, the two quantities normally being proportional.

By way of illustration, figure 2 shows a plot of grid input volts against plate output volts for the 6J7-G triode and under the circuit conditions already assumed.

PATTERN ON SCREEN

In a linearity test with the CRO this is essentially the curve which is plotted by the equipment and which appears on the screen. The exact slope of the line depends, in the case of the graph, on the selected ordinates and, in the case of the CRO, on the gain of the respective deflecting amplifiers. The significant feature is rather in the overall shape of the curve and the degree of plate or grid swing which is involved in the particular stage.

Examining figure 2 more closely reveals that the centre portion of the plot, though exhibiting a gradual curvature, is reasonably straight. However, for grid swing more negative than about —14 volts, the line flattens off rather rapidly, indicating that the tube can no longer provide linear amplification of signals in this region of its characteristic.

At the other extreme, the line appears to remain linear right up to, and past, the zero bias point. In actual fact, at or about —1.0 volt bias, the grid commences to draw current and to load the input circuit. A saturation effect is also likely to occur in the valve so that curvature must be allowed for in the operation of a stage in this region.

In other words, the overall dynamic characteristic curve of an amplifier stage tends to look rather like an opened-out "S," with a fairly straight portion in the centre and an elongated bend at each end. For linear amplification, it is essential to avoid driving the grid into either region of curvature.

Operation in the curved portion of the dynamic characteristic can be brought about by one or two circumstances. In the first place, the bias may be initially too high or too low, in which case the signals will suffer distortion, almost irrespective of their amplitude.

Correct operating conditions can be ensured by proper use of valve data. Some manufacturers supply tables listing a variety of popular valve types, together with suggested values of plate load and cathode bias resistors for representative figures of supply voltage. It will be appreciated that the optimum bias depends not only on the valve type but on the specific operating conditions.

SCREEN VOLTAGE

With pentode valves it is necessary also to provide the correct screen voltage, as this is intimately related with the grid and plate potentials.

In the second case, operation in the curved portion of the characteristic can be brought about by the application of excessive grid swing, even though the initial bias may be correct.

Taking the curves of figure 2 as a

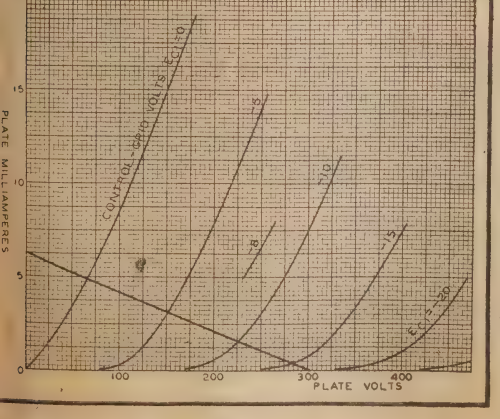
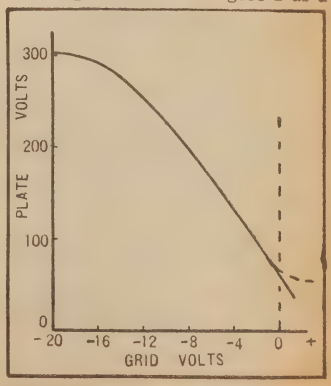


Figure 1. (left). A plate family of curves for the 6J7-G connected as a triode. Note the load line which has been drawn across them for purposes of illustration.

Figure 2. (right). An input versus output curve for the 6J7-G triode derived from the load line shown in figure 11.



pecific example, the optimum bias s about 7 or 8 volts, representing the entre point on the straight portion of he dynamic operating curve. A peak rid swing of up to 6 volts would arry the grid in either direction just bout to the limits of the "straight" ortion of the characteristic. A sig- al much greater than this would arry the grid into the region of evere distortion.

Referred to the plate voltage scale, his would represent a peak swing f about 100 volts on either side of he mean value, which corresponds o about 175 volts.

All these figures refer, of course, o a specific valve type and to a pecific set of operating conditions.

With pentodes or high-mu triodes, aving higher stage gain, the initial rid bias is usually much lower, like- vise the permissible grid swing, for ull output from the plate.

UTPUT VOLTAGE

The peak plate swing also varies vith the supply voltage and with he class of valve. Pentodes give a uite large voltage swing for moder- te distortion, but high-mu triodes re poorer in this respect than nedium or low-mu types.

However, despite these reserva- ions, voltage amplifier valves are ot likely to produce much distor- ion in the preliminary stage (or tages) of an amplifier.

The matter of peak output volt- ge must be watched, however, in the tage preceding the output valve, par- icularly where the latter is a low nu power triode. Phase splitters ave to be watched, because their utput is shared between two chan- els, while valves in compensation tages may also be pushed near the imits if care is not taken. Most ompensating stages employ a fre- uency-conscious divider in the out- ut circuit which feeds only a frac- ion of the total plate output to the ollowing grid circuit.

Thus, even though the useful out- ut may be a volt or so, the peak wing at the plate may be from ten o twenty times this figure.

As we have pointed out already, it s most uneconomical to have the ower of an amplifier limited by verload in any but the output stage. Consequently, one of the chief pur- oses in checking an amplifier is to nsure that preliminary stages are vorking within their capabilities, up o the point where the output stage eaches overload.

NATURE OF PATTERN

Some of the points to be watched vhen making these checks have lready been outlined in an earlier rticle. The concern at this stage is nore with the interpretation of pat- erns seen on the screen.

It may have been logical perhaps, o show the trace from a linear stage s a basis for comparison. However, s we have already indicated, the inearity trace would be simply a traight line, while the correspond- ng wave train would be perfectly inoidal in form. The obvious nature f the pattern is justification for its mission.

Figure 3 is the linearity trace for stage which is operating over a

TYPICAL DISTORTION PATTERNS

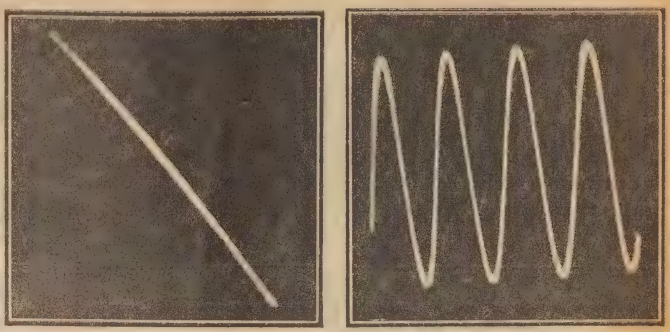


Figure 3. A linearity trace for a voltage amplifier stage extended over a substantial portion of the characteristic but not into either bend. On the right is the corresponding wave pattern.

substantial portion of its dynamic characteristic but not into the regions of obvious curvature. The resemblance between this and the centre portion of figure 2 is apparent.

The trace is actually much heavier than it need appear on the screen for actual viewing. There are two reasons for this, namely, the necessity for high brilliance for photography, and secondly, the tendency for the trace to wander during the exposure—a result of operating from an emergency power plant.

The corresponding sine wave pattern is seen in figure 4. Allowing for the limitations of reproduction, as already mentioned, the pattern appears to the eye as a regular sine wave and does not show any real evidence of the slight curvature which is apparent from the linearity trace.

In actual practice, figures 2 and 3

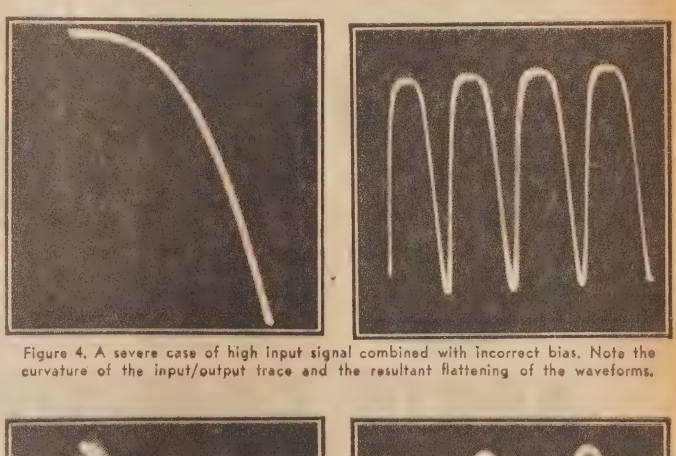


Figure 4. A severe case of high input signal combined with incorrect bias. Note the curvature of the input/output trace and the resultant flattening of the waveforms.

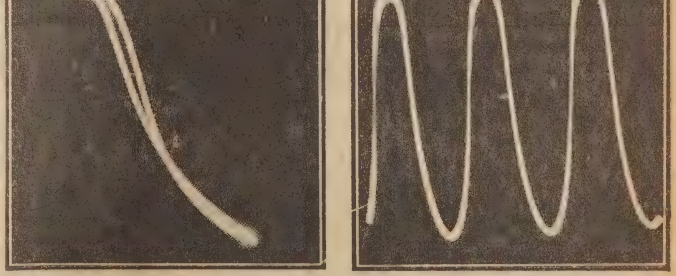


Figure 5. The combined effect of high signal level and ill-chosen operating conditions. The curve, actually for a pentode, would probably be improved by a different choice of screen and cathode potentials.

would represent the patterns which one would expect from a voltage amplifier immediately preceding the power stage in ordinary equipment. Some second harmonic would be present but would be diminished in many cases by suitable application of negative feedback.

Figure 4 shows a typical linearity curve for an overbiased stage and the grid is obviously swinging into the curved portion of the characteristic.

Too little bias will produce a similar trace, the curve in this case being due to the effect of grid current as already mentioned. It does not follow that the curvature due to one cause or another will be at a particular end of the trace, since this is purely an accident of connection to the C.R.O. terminals. The point is that the bias is obviously wrong and corrective measures would need to be taken.

The effect of the non-linearity on waveform is painfully obvious in the accompanying wave train. The waves extend to normal peaks in one direction but are severely rounded in the other, where the plate voltage cannot follow the grid excursions.

In figure 5 is seen the results chiefly of excessive input and output voltage which is revealing both

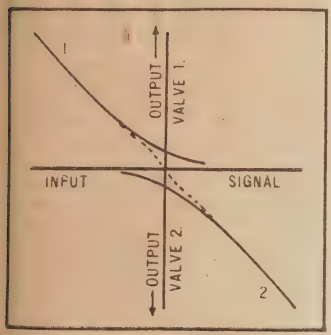


Figure 6. A composite dynamic characteristic of the type used for graphical push-pull analysis.

bends of an amplifier characteristic. It would be necessary almost to halve the signal amplitude before a reasonable linear characteristic would be obtained.

This particular curve is for a pentode valve and can be compared with dynamic operating curves which have been published for valves like the 6J7-G. A variation in both screen and cathode voltages could conceivably give a longer "straight" portion and allow linear amplification for larger signals than the curve at present suggests.

Another interesting point about this curve is that it reveals the effect of phase displacement in the particular equipment on which the test was made. The degree of phase shift varies with frequency and it is often handy to be able to vary this in order to select a frequency where the phase shift is zero or nearly so.

The effect of the curvature on the wave pattern is again obvious. Note

FOR PUSH-PULL AMPLIFIERS

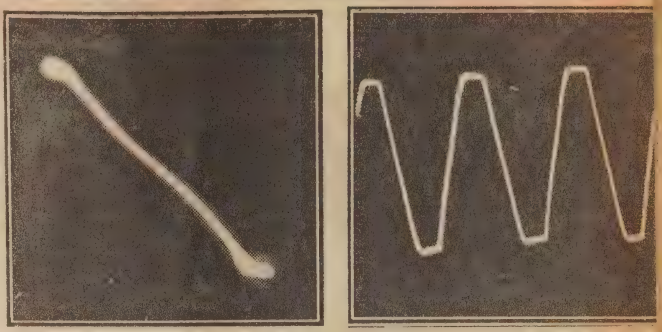


Figure 7. A much overloaded but otherwise balanced push-pull output stage. The reason for the slight "kink" in the centre is explained in the text.

that the sharper bend produces an almost flat top on the sine wave while the more gradual bend towards the bottom imparts to the waves an exaggerated roundness.

All these figures have referred to a class A voltage amplifier but they hold good in principle also for a class A power valve operating into a coupling transformer.

Before the push-pull case can be appreciated, it is necessary to introduce a composite dynamic curve, represented very simply in figure 6. While it must remain the task of textbooks to communicate the full construction of a composite curve, it can readily be appreciated that two single curves, placed back to back, can represent the plate current excursions of two push-pull output valves.

The degree of overlap depends on whether the valves are operating in class A or class AB conditions, the latter being assumed in figure 6. The dotted line indicates the effect of the combination of currents in the output transformer. Ideally it should be straight but a slight curvature is not uncommon.

Figure 7 shows the characteristic of a push-pull amplifier under overload conditions. Note that both valves show the same degree of overload, indicating good balance between their outputs. In an unbalanced amplifier one valve would overload before the other.

There is also a slight curvature near the centre of the characteristic which might indicate the wrong choice of bias or load. In practice however, the extra bias was being generated by the grids drawing current under overload and adding to that already applied in the cathode circuit.

EFFECT ON TIPS

The kink in the sides of the sine wave is only just perceptible, but the squaring of the tips is obvious.

Deliberate exaggeration of the bias and simultaneous overload produced the rather fantastic result of figure 8. The phase displacement separates the kinks in the up and down traces but the discontinuity between the current cycles of the push-pull valves is apparent.

It is even more apparent in the wave pattern. Before this stage could be considered ready for a power output measureemnt the bias would have to be decreased or the load varied to remove the discontinuity and the signal input backed off to obviate flattening of the peaks.

Only then could the output meter be read and the result converted into "watts output."

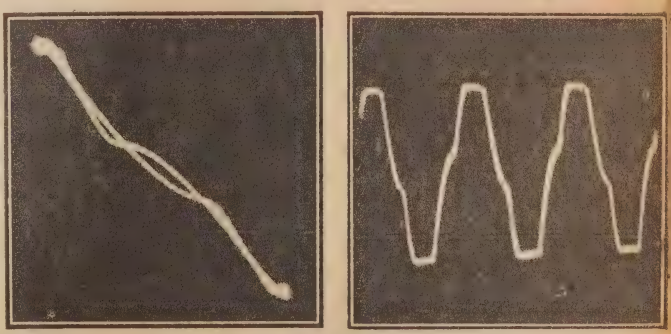
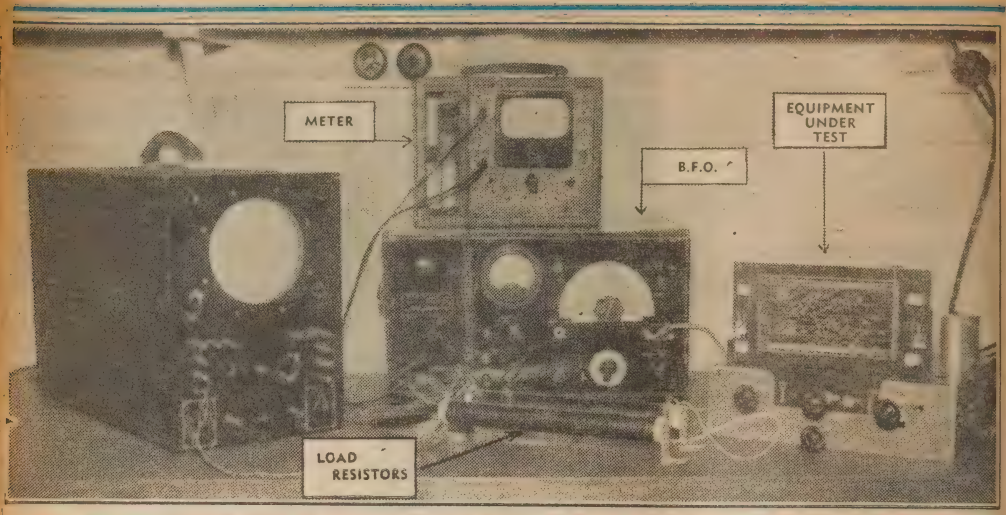


Figure 8. The combined effect of overload and excessive bias. Overload flattens the tips of the waves, excessive bias puts the "kink" in the centre.



This picture shows a typical set up for measuring power output. It is just one of the many jobs calling for an output meter.

USING AN OUTPUT METER

Directions covering receiver alignment frequently make reference to "the output meter". This article explains the significance of the term, how an output meter can be built, and how its functions can be performed by an ordinary universal multimeter. A few pointers on power output calculation and response measurements are included for good measure.

by Philip Watson

PERHAPS the best general definition we can give, is to say that an output meter presents to the eye an accurate measurement of the volume in the speaker.

To be more precise we could say "A meter to measure power output," but the serviceman need not be too exact about this, as we shall see later.

However, a lot of output meters do just that, although the units in which the power is measured may vary quite a deal. The choice of units, in fact, depends on the use to which the meter is put.

MONITORING

For example, the broadcast engineer, carefully monitoring his programme level ,will probably have his instrument calibrated in VU (volume units). The PMG technician, checking land lines, would find db. calibrations most useful, while the laboratory worker, engaged in receiver sensitivity measurements, would need to work in watts or milli-watts.

In order to appreciate a serviceman's requirements, we might first consider why an output meter is necessary at all. It is simply because the ear is not sensitive enough to detect small increases in volume level when aligning a receiver. For all practical purposes it may be considered that volume changes of less than 2 decibels cannot be appreciated by the ear, while a meter will clearly show a change by only a small fraction of a decibel.

At this stage you might well ask "If the improvement brought about by the use of a meter is so slight that it cannot be heard, what is the point in using it?" There might be some grounds for this argument, were it not for the number of steps required to align a receiver.

Taking a normal 5 valve superhet as an example, the primary and secondary of both IF stages account for four adjustments. Add the aerial and oscillator trimmers at the high frequency end, and we get a grand total of six. Now assume that each of these adjustments, set by ear, has been brought to within 1 db. of the optimum, then the total loss is 6 db., which is a very real one.

From the above we may also deduce that what a serviceman requires is not so much a power output meter as a voltage output indicator, capable of showing the relative merit of one adjustment setting against another. This simplifies things considerably, as we have no longer to consider the actual value of output, except in a very general way.

The basis of practically all output meters is a sensitive milli-ammeter of the moving coil variety. In the case of the VU meter, mentioned earlier, the correct damping of the movement is an important factor but, apart from this, any standard meter movement may be used.

Fundamentally, such meters are capable of reading d-c only, while the audio signals which are to be measured are a-c. This means that we must add to the meter movement some form of rectifier, usually a full-wave copper-oxide type.

TOO SENSITIVE

The meter in this form is far too sensitive for normal applications, and resistance is usually added in one leg of the rectifier on the a-c side. The instrument, which we now have, is really an a-c voltmeter, but we may calibrate it to read other units, for example, watts, if we so desire.

However, this latter step involves the rather difficult job of relating the meter readings to a selection of built-in load resistance values, so that a complete output meter, in the true sense of the term, is a rather complex device. It is not surprising,

therefore, that for receiver alignment, the enthusiast or the serviceman is usually content with a meter which simply indicates output volts and which therefore shows the effects of the adjustments being made.

Most commercial multimeters provide an "Output Volts" position on the selector switch, or corresponding pin-jack. This brings into circuit a condenser which blocks the d-c and restricts the reading to a-c signal voltages being measured.

When using the "output" range on a multimeter, arrange the swtich or pin-jacks as required and set the a-c voltage selector to the highest range.

One lead from the meter is connected to the plate of the output valve, and the other lead to any part of the chassis. Now feed a signal through the receiver from the oscillator and adjust the level to a reasonable value in the speaker. The voltage selector may now be set to lower ranges in turn, until the meter reads approximately quarter scale.

As the various stages are brought into line and the meter reading increases, the output from the oscillator should be reduced. When alignment on that range is completed, switch to the highest range to protect the meter against possible overload next time it is used.

WATCH FOR OVERLOAD

It is very unwise to search for a signal, by tuning across the band, with the meter switched to a sensitive position, for the signal may be a lot stronger than expected. After the receiver has been set up for the next alignment stage and a signal of reasonable strength received, the voltage selector may once more be moved down to a convenient setting. Alignment then proceeds as before.

If the multimeter has no output position, use can still be made of the a-c voltage ranges for output measurement. However, special note has to be taken of the connections to the receiver.

If the meter were to be connected, as already suggested, between the output plate and chassis, it would give a high initial reading due to the d-c potential difference between the points of connection. An output signal equal to say 20 volts might only change the needle deflection from about 250 to 270 volts, which is a relatively small increment of change. Were it not for the d-c component, the meter could be set to a more sensitive range and made to give a substantial reading based only on the a-c signal voltage.

The difficulty can be overcome by connecting a good quality blocking condenser in series with the plate connection, thereby simulating the effect of the blocking condenser, which is already built into other multimeters.

As an alternative, the multimeter connections can be made between the plate of the output valve and the B-plus supply line without need fo an interposed condenser. The mete will respond initially to the d-c dro across the transformer winding bu it is relatively small and not suffi cient to curtail the usefulness of th meter as an output indicator.

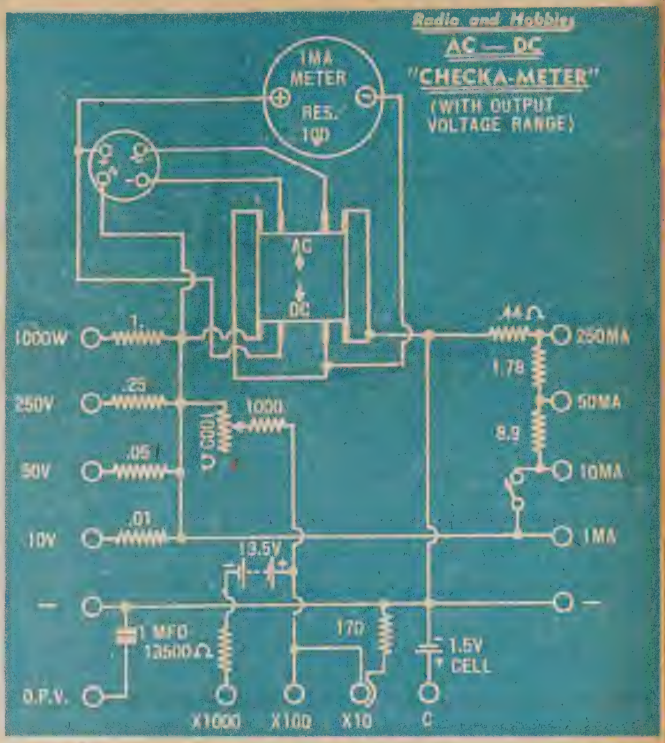


Fig. 2. The popular "Checka-Meter" circuit modified for use as an output indicator. The additional condenser and pin-jack socket are shown in the lower left hand corner.

Obviously, the "output" position i a very valuable addition to a multi meter, particularly as the added cos is not great. However, it frequentl happens that the multimeter i needed elsewhere, just when a alignment operation is contemplatec Or again an intermittent receive may need to have the output check ed, while vital voltages are als supervised. As a result we find tha many fellows like the idea of separate output indicator, in additio to the one provided in their multi meter.

COMPONENTS

Figure 3 shows a typical circu of such a unit and its similarity to th a-c ranges of a multimeter will b obvious. Really the only additiona item is the blocking condenser, th function of which has already bee outlined. One socket includes th condenser, while an alternativ socket gives direct access to th metering circuit for tests where th d-c blocking effect is not required

Now a word about the componen values. If all that is required is simple output indicator, approximat

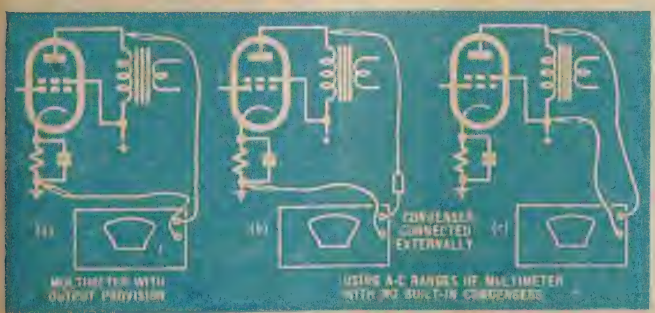


Fig. 1. Most a-c meters can be used as output indicators. Methods of connection for various types are shown here.

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values only are required. However, ome readers may care to go to a ittle more trouble and finish up vith an accurate a-c voltmeter. Such meter will permit accurate power utput calculations to be made, and s useful when checking amplifiers, &c., for rated power output. Therefore, we are providing exact component values for those who may vant them, while those whose requirements are not quite so exacting may substitute approximate values for the one shown.

Most of our calculations centre round the losses in the rectifier, so ome details of these may help the eader to better appreciate our choice f values. The copper oxide rectiiers, such as types MBS1 and MBS5, have a resistance on the a-c side of pproximately 1000 ohms. As this is ffectively in series with the multiplier, it should be 1000 ohms less han the equivalent multiplier in a l-c circuit.

RESISTORS

Another point is that the rectifier delivers only 0.9 mA d-c to the meter when 1.0 mA is flowing in the a-c side. This brings up the question of meter sensitivity and, if you are buying a new meter, it would be best to specify a 0.9 mA movement. This will enable you to use multiplier values which are reasonably standard, and it may be a good idea to order these at the same time as the meter.

Standard resistors should be available from meter manufacturers for 10, 50, 250 and 1000 volts. The actual resistance values for the above ranges would be R1-8500 ohms, R2-9,000 ohms and R3-0.25 megohm. The 1000 volt range should be made up by adding three more 0.25 megohm resistors to the 250 volt multiplier. A single resistor should not be used here, as most resistors drift badly with more than 250 volts across them. These are shown as R4, R5 and R6 in Fig. 3.

The impedance of the blocking condenser is effectively in series with the multipliers so the capacity should be fairly large if our multiplier calculations are not to be upset. 1.0 mfd or larger should be satisfactory for use at 400 cycles. Some excellent condensers for the purpose have been available among disposals gear.

MULTIPLIERS

It is quite possible, of course, that you have a standard 1.0 mA meter on hand, or that you have been considering some of the attractively priced meters now available through disposals. These can be used by resizing the multiplier values and the size of rectifier. It is advisable to use a 5 mA rectifier as a 1 mA will be slightly overloaded at full scale. The 5 mA unit is usually available at no increase in price.

The multipliers in this case would be R1-7500 ohms, R2—44,000 ohms and R3—227,000 ohms. For the 1000 volt range R4, 5 and 6 should provide an additional 680,000 ohms divided approximately equally between all three resistors. It is quite obvious that these resistors are non-standard, even though they have been worked out to round figures. It is quite probable that the only way of securing these values would be by making series or parallel combinations, or by selecting them on the low tolerance side of more standard values.

A method of avoiding these awkward values with a 1.0 mA meter is to re-vamp the scale. This calls for a little care and ingenuity, but it should not be beyond the ability of the average enthusiast.

Remove the meter from its case and, with a pair of dividers, divide the arc into ten equal divisions between zero and the 0.9 mA mark.

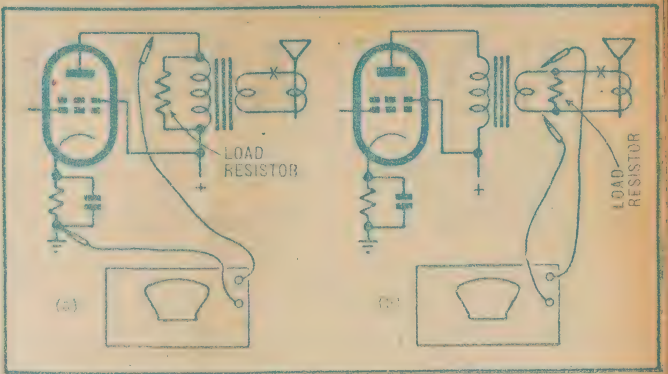

Fig. 4. Showing the two positions at which power output measurements are usually made, and how the load resistors are connected in each case.

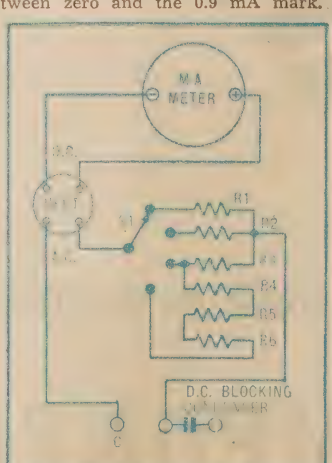

Fig. 3. Circuit diagram for the separate output meter. Component values are discussed in the text.

Make all your markings in light pencil until you are quite sure of the positions, after which they may be finished off with Indian ink. Each division now represents 1 volt on the 10 volt range and should be multiplied proportionately for higher ranges.

Incidentally, many multimeter scales have the a-c ranges equivalent to 0.9 of the d-c range for this very reason. You may be able to obtain one of these special scales for fitting to an existing 1-milliamp movement.

The use of an a-c voltmeter for power output calculations will call for a set-up similar to that shown in the accompanying photograph. The audio signal generator should provide a signal at approximately 400 to 1000 cycles, with reasonably pure wave form, and with a voltage output approximately equal to the input sensitivity of the amplifier.

It is usually desired to know the maximum power output of an amplifier, that is, the output level at which distortion commences, and a C.R.O. is the most practical instrument to indicate this level. (An article elsewhere in the issue covers this subject).

Next we must provide an accurate load into which the amplifier is to work, and this raises the question as to whether the measurement is to be made at the plate of the output valve, or across the secondary circuit.

LOAD RESISTANCE

Both of these measurements have their uses. The first indicates whether the valve is delivering its rated output, while the second shows the power actually delivered to the speaker. The inevitable difference between the two figures is due to the losses in the output transformer, the efficiency of which may be anything from fifty to ninety per cent.

If we decide to work at the plate of the valve we will require a load resistor equal to the load specified for that valve. For example a 6V6 with 250 volts on plate and screen requires a 5000 ohm load resistor, which must also be capable of dissipating the expected power, about five watts in this case.

The load resistor is connected across the primary (see figure 4a) and all load removed from the secon-

dary. The output meter is connected between the plate of the valve and the chassis, or in the case of a push-pull circuit, from plate to plate. The audio signal is now fed into the amplifier and the output level raised until distortion shows on the C.R.O., reduced until the distortion is just cleared, and the output voltage is then noted.

To measure the power being delivered to the speaker, a load resistor is required to match the transformer secondary impedance. This may vary from two to fifteen ohms for a voice coil circuit, being much higher for a line transformer. Again, the resistor must be capable of handling the expected wattage. The output meter and load resistor are connected across the transformer secondary and the voice coil disconnected. (Fig. 4b). As there is no d-c present here the blocking condenser may be dispensed with. The actual measurement procedure will be the same as with the plate connection.

If you are using a transformer having more than one secondary tapping, the selection of a resistor to match the highest impedence has some advantage. This is simply in order that a higher voltage will be generated for a given power, and so provide a more convenient reading on the voltmeter.

The point behind the foregoing is that, for power output measurements, it is essential to provide a resistive load and secondly to measure the voltage actually developed across that load.

SPEAKER IMPEDANCE

The impedance characteristic of a speaker is far too uncertain to accept as the basis for calculation. Furthermore, the inevitable losses in any output transformer and the resulting mis-match, make it unsatisfactory to load one side of the transformer and base calculations on the voltage across the other side.

In the event of a C.R.O. not being available, the overload point will have to be judged by ear. This means that the speaker must be left in circuit, which obviously conflicts with the requirement of providing an accurate load on which to base calculations.

The best method would seem to be the insertion of an isolating resistor in series with the voice coil(point "X" in Fig. 4). The resistor should be made as high as possible consistent with a useable level in the speaker. If it can be kept at ten times, or higher, than the nominal voice coil impedance, the additional loading should not be serious.

The procedure with this method is to raise the level until audible distortion is obvious, then reduce it to a little below this point, Cut the speaker out of circuit and note the voltage reading across the load resistor.

A WARNING

While we are on the subject of voice coil circuits, a word of warning may not be out of place. The output transformer is not, in itself, capable of providing any appreciable

(Continued on Page 99)

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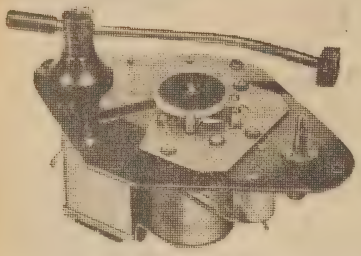

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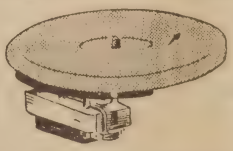

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FROM THE SERVICEMAN WHO TELLS

As I write these notes, a lot of folk further north are busily scraping mud off walls and out of cupboards—the result of another wave of disastrous river floods. While I have not received anything more than wet feet out of it all, a couple of experiences within the last few days have underlined the problems of servicemen in those areas.

ONE client rang to say that his set had been going for a few minutes the previous evening when he noticed a burning smell. By the time he realised it was coming from the radio, the back of the cabinet was filled with smoke. Could I please come over and have a look at it?

Yes, the radio was still playing when he switched it off! In fact, he "had it on again for a few minutes this morning, but it started to smoke again."

There could be little doubt that a power-transformer would be the offending item. Other things in a set can burn and smoke, but most of them put the set out of action before they begin. A power-transformer just smoulders and smokes until it blows itself or the fuses.

I must confess to an uneasy feeling as I recalled the experiences of my tender years, when power-transformers were not quite so reliable. They tended to short and heat up with no prior notice, depositing a filthy, gooey mess all over the underside of the chassis. As often as not, the chassis had to be stripped and almost completely rebuilt before it could be returned to its owner. I sincerely hoped that such a step would not be necessary in this case.

FAILING INSULATION

It turned out that the set had not been used for about a month previously, the family having synchronised their holidays with the recent big wet. They had only just come home when the set had failed.

Fortunately, there was no mess anywhere, the only hint of a transformer failure being the familiar smell of burnt insulation. Without further ado the chassis was taken back to the shop.

Here, my first action was to have a close look at the wiring and the rectifier socket, just in case the wiring rather than the transformer was to blame. But no, everything appeared to be in order. When switched on for a moment, the transformer hummed suspiciously and the pilot light over my power point dimmed perceptibly.

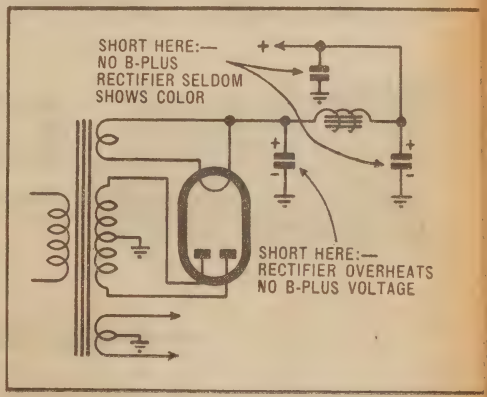
I lifted all the wiring away from the panel and tried again, but with the same result. The transformer has definitely "had it." As a matter of interest, however, I flicked it on a couple more times and took snap readings of the various voltages. One side of the secondary read much lower than the other, indicating, apparently, a short between successive layers.

Needless to say, a new transformer was fitted and the set returned to its owners, with a necessarily rather stiff account. I might have forgotten the matter altogether, had it not been for a similar incident the very next day.

A set had come in for service a couple of days previously — one of those jobs for which there was no particular hurry. The family had another set, which was normally used, anyway, but the old one was to be reconditioned for the son and a new daughter-in-law — I forget all the details. However, the point of the story was that the set had "gone on the ice" some weeks previously and was only brought in for attention when a family re-shuffle was imminent.

The actual cause of failure proved to be a broken-down B-plus bypass, which was quite readily located and fixed. When a set is completely dead, the first test is always to check on the B-plus line. There are two popular methods: (a) with a voltmeter, and (b) with a screwdriver.

A simple failure was a broken down B-plus bypass. However, the transformer failed due to moisture while the set was being tested.



If there are no volts on the B-plus line and the rectifier is not red-hot, it will almost certainly be the second filter condenser gone or the 0.1 mfd. bypass.

I duly wired in a new condenser, replaced the electrolytics and was in the process of lining the thing up when I heard a rustling noise somewhere in the chassis. The reason for it was not obvious until I noticed the familiar smell of burning insulation. Rectifier . . . no! Condenser . . . no! Wow . . .the transformer!

Once again the procedure of disconnecting the leads and measuring voltages, and once again the disturbing discovery of different voltages on either side of the high-tension centre-tap. Needless to say, the job was a lot more complicated and more costly than originally suggested by the broken down 0.1. But it naturally set me thinking.

In both cases, and for different reasons, the receivers had been inoperative during the wet spell, and, while householders were complaining abo fungus growing in cupboards, som thing very similar was going on their entrails — I refer, of course, the receivers. Moisture was collecti in unprotected nooks and crannie fungus was possibly growing and i sulation was suffering as a cons quence.

LOCAL HEATING

When the set was switched on, lea age currents and local heating o curred, being most serious at t points of highest voltage — in th case the power-transformer secon ary. In the race between leakage cu rents and the drying-out process, t former won out, the insulation bro down completely, and, "poof!" — a other tranny "bit the dust."

As a matter of interest, I had yarn with a pal of mine whose jo in life is to make transformers. H was quick to point out that the pr blem I mentioned was an everyda one in more northern climes an became a really tough one for signal personnel in New Guinea and th islands, during the war. Very pretty equipment, turned out in the bes style by American and Australia factories, looked like a market gar den after a few weeks in the tropic —and smelt like one when thing began to break down. Hence th "tropic proofing," which amateur cuss when they come to strip dow disposals gear.

However, to get back to the point he said that transformers were orig finally wound and sold without im pregnation at all — just alternate layers of wire and paper. In an effort to overcome the moisture pro blem, it became customary to im pregnate with wax, but, according to my friend, wax tends to flow and split as the windings alternatively heat up and cool off, leaving cracks into which moisture can penetrate.

His preferred technique now is to use a special varnish which, by "hot dip" impregnation, is made to penetrate into the completed wind-

ing. The transformer is then baked at a high temperature and the varnish forms a tough moisture-resistant skin over every surface it can find. The baking oven is well above the normal operating temperature of the unit, so that the protective skin is not perturbed by subsequent heating and cooling cycles during service.

STORAGE

But what about existing or old equipment? The obvious answer is to avoid storing a disused radio in a cellar or a damp cupboard, where it will become an easy victim of the effects I've been talking about. If it has been kept in such a place, put it out in the sun for a couple of days or leave it near a fire to give the moisture a chance to dry out before switching on.

Another good suggestion which I have seen is to hang a lamp inside the cabinet for a few hours. Quite a small globe, 25 or 40 watts will give plenty of warmth inside a mantel cabinet, but a 100 watt lamp is a better proposition inside a console. The warmth of a lamp, burning for about 24 hours, could easily make the difference between a very damp set and one that is not likely to give trouble. After all, you can burn even a 100-watt lamp for 10 hours for the cost of one unit.

If someone had thought of something like this a few days ago, there might easily have been two fewer transformers in my garbage bin.

As far as the household set is concerned, it is not likely to give trouble if switched on as it is normally every few days. The natural rise in temperature will dry the set out each time before the moisture really has a chance to do its dastardly work.

As if to underline what I have said, an amateur friend came round to weep on my sympathetic shoulder. He had just found his only remaining crystal microphone rendered useless as a victim of the wet. Once again, several weeks of wet and cold nights had kept him out of the shack and there were no radiators or glowing "bottles" to dry the air, even temporarily. In the meantime, his crystal mike insert had taken unto itself a load of moisture and was apparently finished for all time.

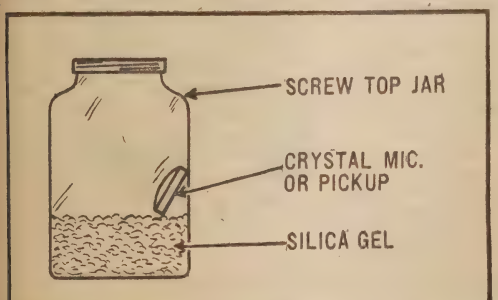
I'm afraid that I can claim only abysmal ignorance of rochelle salt crystals, which, apparently form the heart of crystal microphones and pickups. My friend was so forlorn, however, that I was tempted to try something to help him out, with obviously nothing to lose if the effort failed. It turned out that he actually had two "dud" crystal microphones, the one just mentioned, and one of another type which had been discarded some time before.

The first one had very little output, and what there was of it was very high-pitched. As a matter of interest, I checked the resistance across the terminals with a vacuum tube voltmeter. One is not supposed to apply a voltage across a crystal element of this type, but, on the 50 meg. range of the meter, the maximum current which can flow in the circuit under test is only a few microamps.

Non moisture-proofed crystal inserts can sometimes be dried out successfully by placing them in a container with silica gel crystals.

However, rightly or wrongly, the resistance read as about 0.25 meg. with a tendency for the reading to creep. To my inexpert mind, it looked very much like a case of thoroughly saturated crystal. Whether such a crystal could be reclaimed or not by drying, I had not the faintest idea.

However, the front of the unit was carefully removed, and, between us, we prised up one small edge of the diaphragm with the idea of gaining access for some air into the crystal compartment. The unit was then put in front of an electric fan and left here for several hours.



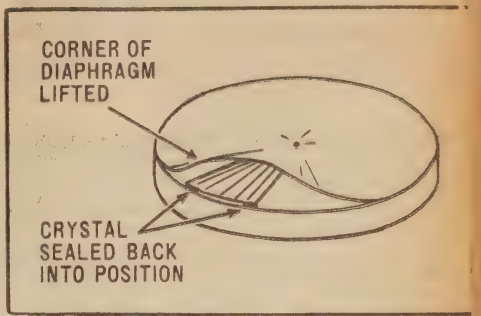
At the end of the time, the resistance was up to just over 1 megohm, the output had more than doubled, and the tone was deeper. Suddenly it clicked. The crystal, because of the moisture content, was providing its own resistive load of a megohm or so and the behavior was exactly the same as if it had been operating into that very inadequate value of external loading.

How another crystal insert was restored to operation. The crystal was re-seated on its little mounting blocks.

Then I had another idea. Why not buy some silica gel—the stuff that is used quite frequently for keeping things dry?

A visit to a chemical supply house ultimately produced a half-pound of the stuff for a few shillings, branded "self-indicating" and supplied in a screw-top jar. The assistant explained that the bluish crystals would gradually turn pink as the stuff absorbed moisture. It was then necessary to dry it out in the oven, and it could be used again many times as necessary.

I took the jar back to the shack, dropped the crystal unit inside, and shut up for the night. I refer, of course, to the premises. Next morning the crystal gave me a reading of about 5 megohms, and by evening it was up to 15. Output and tone balance were back to normal, as also were the spirits of my amateur friend. How long they will remain that way has yet to be seen.



CRYSTALS AND HUMIDITY

I do know that, when these crystals get really wet, they just about dissolve and fall apart and there is no more hope of putting them back together again than the drips from a kid's iceblock.

There's apparently not much point in fiddling with the mechanics of the device either, because if the seal won't keep the moisture out, it certainly won't keep it in either. How permanent the effects of drying are, of course, is something I don't know offhand, but a "coupla bobs worth" of silica gel is worth gambling in the effort to save a mike or pickup.

I must confess to having a look at the other unit also—the one which had been out of use for a long time. It was well sealed and showed the resistance of several megohms, but there was hardly any output. It looked like the case of a cracked crystal.

Lifting one side of the diaphragm, however, revealed that the crystal was actually floating free of the little rubber blocks to which it was meant to attach. Instead of being held by the vibrations of the diaphragm, it was merely flapping around in mid air.

A visit to the boudoir produced a small bottle of clear nail polish (or lacquer), complete with a small brush attached to the stopper. Thus equipped, I managed to put a spot of the lacquer on the anchor points, and by dint of much blowing and holding, managed to get the crystal seated in place.

After a period for drying, the edges of the diaphragm was sealed down again with more nail polish, the case reassembled and the unit tried out. Yes, it worked. My amateur friend

(Continued on Page 99)

Here's your answer, Tom!

Appropriately enough, Tom this month is a lad of some fifteen summers, hailing from Bondi, NSW. From the tone of the questions he is obviously interested in the practical side of radio, not, we hope, to the detriment of his studies in English and History.

THE first question is one which pops up every now and again in the mail. Apparently there are a lot of deaf people in our midst, or keeping babies, or teenage children with other interests.

How can I connect phones to a loudspeaker on an electric set?

This is a "curly" question, Tom, and one that we really could not answer fully without a whole series of circuits.

The first point to remember is that electric sets nearly always operate with the best part of 300 volts on the high tension line. The second point is that your head is a very sensitive spot, when it comes to receiving an electric shock. In other words, any method of connection should avoid the risk of shock in the event of headphones developing a fault or the cords becoming frayed.

The best way of avoiding the risk is to keep the headphones clear of the high tension circuit altogether, operating them through a transformer of some description.

Without going into a lot of detail, the simplest method is to locate the connections between the output transformer, which is normally mounted in the speaker, and the voice coil of the speaker. These leads seldom, if ever, have any connection with the supply voltages in the set.

Connect one phone lead to one side of the output transformer secondary and instal a switch so that the other side of the secondary connects either to the remaining phone lead or to its original connection on the speaker voice coil. Throwing the switch this-way-and-that will automatically connect the output of the set to the phones or the speaker.

You will need to retard the gain before switching to phones or you will blast either the phones or your ears out of existence. Besides that, it is not a good thing to have the output valve working hard into the rather dubious load provided by a pair of phones.

With this method of connection, you can use low impedance (nominally 400 ohms) phones, as commonly available from disposals dealers. Best of all are the dynamic phones from the same sources, which have excellent quality characteristics, although rather heavy to wear.

If you want earphone reception as well as the loudspeaker, simply connect the earphones across the loudspeaker voice coil.

I am interested in building up a set like your "Tex," but in a smaller cabinet. Would it be all right if I wound up a new loop aerial using the same lengths of wire for the reaction and grid windings as originally specified?

We've only got ourselves to blame for the form of the question, Tom. We were getting so many letters from readers who wanted to wind aerials on cabinets of slightly differing dimensions that we had to suggest something in pure self-defence.

Our suggestion, therefore, published on various occasions, was that they should work out the actual length of wire which would be involved in a published design, by calculating the distance around the cabinet and multiplying it by the number of turns. It was suggested that the new aerial should be wound with a similar length of wire. By working things out backwards, it would be possible to calculate the number of turns which would be required on the new cabinet.

It is a rough and ready method but close enough for small variations in cabinet size. To do the job properly would involve all kinds of factors which would have left the enthusiast completely "cold." Obviously, Tom, you have the right idea, but there are a couple of points to remember.

The signal pickup of a loop aerial depends a good deal on its size and, broadly speaking, a big loop will always be better than a small one. Therefore, if your proposed design involves winding more turns on a smaller cabinet, the signal pickup is likely to be reduced. With a simple reaction set, this could easily be the "last straw."

A further point is that a loop works best when it is in the clear as, for example, in the lid of a cabinet, rather than jammed alongside the chassis or batteries. In your case, it would probably be wound closely around the metallic bulk of the set and would suffer thereby. The smaller you make the loop, the more serious will the effect be.

In the light of all this, the obvious idea is to turn your talents into developing a flat, sandwich-shaped affair that will occupy a minimum of space, in line with your requirements, yet support the largest possible loop.

What are Maxwells and what is flux density?

Not so very long ago, Tom, the term "Maxwell" referred to a very well-known brand of horseless carriage. We're not sure of the dates and details, but we can recall the bonnets, the scarves and the motor coats which

completed the picture in those early days.

Electrically a Maxwell is something quite different. It is defined as the unit of magnetic force in just the same way as the volt is the unit of electrical potential, the amp is the unit of current flow, and so on. We are not so familiar with the Maxwell, because it is much less frequently encountered in an intimate way.

We can measure volts and amps on a meter and see directly their effect in a circuit. We can buy resistors having a value of so many ohms. But Maxwells have no such "tangible" form—they remain essentially the concern of those who have

nothing better to do with their time than design magnets and magnetic circuits.

To give the full definition, however, "a Maxwell is the unit of magnetic flux. It is equal to one line of force." The explanation of flux density follows as a matter of course. When lines of magnetic force pass between a pair of pole faces the number lines or the strength of the magnetic field is referred to as the flux density. It is measured in "gauss" and one gauss is equal to one line of force between pole faces one centimetre square in area.

All this may be a bit of a mouthful, Tom, but it is often referred to in the specifications of a loudspeaker. Generally speaking, the greater the flux and the greater the total number of lines the better will be the magnet and the speaker performance. Of course there's a lot more to speaker design than simply providing a good magnet, but it is pretty safe to assume that a manufacturer does not take a lot of trouble to fit a really good magnet to a speaker which hasn't a lot of merit in other directions.

But we are getting ourselves involved!

Are short-wave "Reinartz" coils available commercially, and, if so, where?

We're always a bit "dicky" about answering questions along these lines because, as sure as we say "No" someone will bob up with the information that so-and-so has been selling them for years.

However, that is the plain truth.

As far as we know, short-wave "Reinartz" type coils are not available commercially. The point is that they are so easily hand-wound that the ultimate demand for them hardly makes it worthwhile for the manufacturers to add them to the catalogue. They are normally wound with solid enamelled, wire and the home constructor can wind a coil to be just as efficient electrically as one wound on an expensive machine.

We have published coil data for reaction sets at various times but can always supply a specimen sheet of coil data for small receivers through the shilling query service.

I have noticed circuits using only nine volts on the 1Q5-GT. Would any disastrous results follow from connecting these sets straight to 45 or even 67½ volts?

No, Tom, not at all, unless you consider a ruined valve, run-down batteries and burnt-out phones in the nature of a disaster.

You see, it works out this way. When a valve has only about nine volts on its plate it simply cannot draw much plate current and there is no need to worry about grid bias. In fact, the operation of the valve is so limited by the plate voltage that the application of grid bias would only cut off the plate current altogether.

Start to wind up the plate volts, however, and the plate current begins to soar, particularly in a power valve like the 1Q5-GT. Just to illustrate the point, with no protective bias on the grid, it would draw between seven and eight milliamps of plate current at 45 volts, about 14 mills at 67½ volts, and nearly 22 mills at 90 volts. You can add a few per cent to these figures for the screen.

Very obviously the drain even at 45 volts is enough to keep a small battery fully occupied, and instead of working on and on it's life would be about the same as if it were running a full five-valve superhet. With the higher voltage figures the valve itself is likely to turn up its toes a bit, while not even a self-respecting pair of earphones can be expected to carry over 20 milliamps for too long.

APPLICATION

There's one other point—how many more times are we going to use that phrase—but it concerns the application of the valve.

When a 1Q5, or any other valve for that matter, is used as a grid detector it must not have bias applied. Therefore in order to keep the plate current within reasonable limits it is necessary to set a limit on the plate (or screen) voltage.

On the contrary, as an amplifier the valve should have bias on the grid, both to keep the current within reasonable limits and to ensure distortion-free amplification. To discover the order of bias for any particular valve and operating voltage it is necessary to consult a valve chart. If these are over your head, Tom, then follow an approved circuit design.

I am puzzled about some of your circuits using back bias. Why do you suggest that the valves only draw, say, 60 milliamps when, added together, the published figures might amount to 80 milliamps? On which figure do you base the resistor value?

This question certainly puzzles more readers than yourself, Tom, b the explanation is not a very involv one.

Let's take the case of the simp five-valve set featured last month.

The 6V6-GT is rated for a pla current of 45 milliamps and an ext 4.5 milliamps for the screen. T 6B6-G has a plate current rating 0.9 milliamps, the 6SK7-GT of 1 milliamps total, and the X61-M 10 milliamps, making 72.2 mills in a

However, we know from experien that a simple set of this nature seldom called on to deliver the f 4.5 watts of audio power of whi the output valve is capable. It reasonable, therefore, to overbias t output valve, cut down its plate cu rent and make things easier for t rectifier as well. The power tran former and choke can be made a litt less pretentious and costly into t bargain.

From experience we know that 6V6-GT behaves something like 6F6-G when the bias is increased, s more or less as a matter of cours we planned for a bias of about volts and a total plate plus scree current of just under 40 milliamps.

The 6B6-G is connected as a resis ance-coupled amplifier, and the pla current is not likely to exceed abo 0.4 milliamps in this service—a figu so small that it can be neglected.

The X61-M will draw its 10 mill anyway, but the 6SK7-GT will no mally run at about half the rate current by reason of the AVC voltag generated by the local stations. Let say 6 milliamps at the outside.

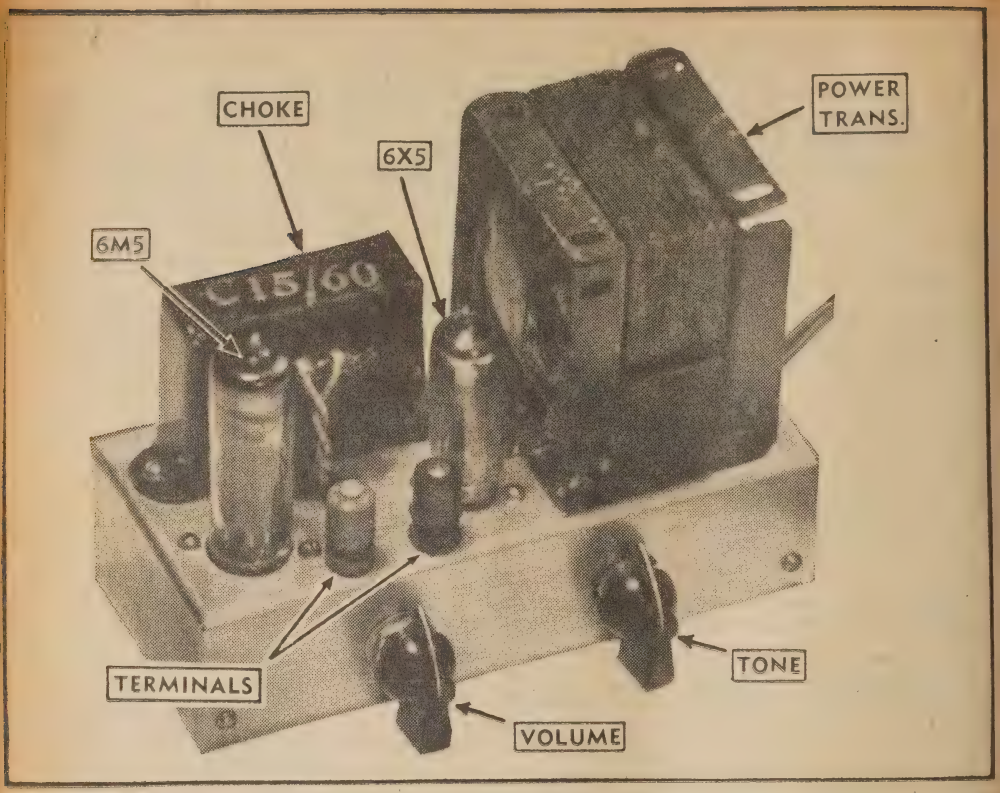
In other words, the total plate cur rent is likely to drop to 40 plus 0 plus 6 plus 10, equals 56.4 milliamp Actually, with standard resisto values, the bias is a trifle less tha the suggested figure and the high ten sion current a trifle higher, landin around the 60 milliamp mark. How ever, you will see the point, Tom.

MAGNETIC COLLECTION OF METAL WASTE

APPLIED physics has solved a two-sided industrial problem. A very large number of industries utilises processes, such as turning, sheet-metal working, &c., which give rise to waste. An even larger number employs vast quantities of nuts, bolts, washers, nails, tacks, wire, stables, and so on, some of which inadvertently fall on the factory floor.

This material, both waste and useful, if left as it is, represents an actual financial loss and a potential source of injury to workers. To overcome this double threat to efficiency, numerous collecting schemes have been tried, from picking up by hand to suction cleaners. Manual methods are slow and wasteful of manpower, and machines are frequently damaged by the sharp edges or the weight of the material for collection. Furthermore, the electric cables used with suction equipmen constitute an additional safet hazard.

The problem has now been solve by Rapid Magnetting Machine Co of England. Iron and steel—by fa the two most important industria metals—are normally magnetic, an will thus be attracted to a magnet This fact has been embodied in th Magnasweep floor-cleaner. Basic ally, it consists of a cylindrical mag netised roller, with a traction device As the roller advances, magnetic forces attract to it the refuse, which is automatically deposited into an easily removable container. Various sizes are available: the smallest can be operated by one unskilled worker the largest needs a car or tractor to tow it. In neither case is elec tricity required; in both cases main tenance requirements are negligible



Here is a picture of the amplifier with the main components keyed for reference.

A BABY RECORD PLAYER

If you've never built an amplifier before, here is one that you can tackle with certain success. It has only two valves and less than a handful of components but will play your favorite records at full clear volume. It is small enough to be mounted under the motor board of any portable record player yet can be used with a large speaker for quality reproduction if desired. Add a microphone and you can also use the amplifier for fun at parties.

by Maurice Findlay

A REALLY small amplifier is often a necessity rather than just a novelty. For instance, if you have a pickup and turntable mounted in a portable carrying case it is very desirable to have the amplifier also mounted in the carrying case. Then only the speaker is required to complete the outfit.

Apart from the small physical size, an amplifier of this type has a great appeal to a chap interested in recorded music but who is a comparative newcomer to radio and to amplifiers. There is less than a handful of parts in the amplifier and even a newcomer would be able to mount the components and complete the wiring in a couple of evenings. In fact, if you have had some experience with a soldering iron you should have no difficulty in completing the whole job in a few hours.

Not that we suggest the amplifier be built in the shortest time possible. It would be foolish to spend several pounds on the kit of components and then spoil the job for the sake of a couple of hours extra time and care.

The amplifier consists basically of a single power amplifier stage and a power supply. This latter involves a power transformer with a 6.3 volt winding to operate the heaters and a high voltage winding to supply the rectifier plates

The rectifier converts the a-c impulses from the transformer into pulsating d-c, which is filtered by the combination of a choke and two condensers, to remove the pulsations, or the ripple. In this filtered form, at just under 250 volts, it is suitable for application to the plate and screen of the output valve.

The extremely small size of our amplifier is largely due to the use of miniature glass valves. These are little thicker than a fountain pen top and about the same length. The amplifier valve we have suggested is a 6M5. It has extremely high gain, combined with quite a respectable power output. Direct equivalents of this valve in the larger series are the EL33A and the EL3NG.

For the rectifier we have chosen a 6X4, a direct equivalent of the 6X5-GT, with which many readers will be familiar. It is an indirectly heated type and the heater/filament insulation is especially designed to withstand a considerable voltage. The heater may thus be connected in parallel with the 6M5 heater.

CONVENTIONAL AMPLIFIERS

Conventional gramophone amplifiers employ one or more stages of amplification preceding the power amplifier, and this is necessary where low or medium output pickups are used. In fact, the majority of modern lightweight pickups require bass compensation as well as high gain in the amplifier, so that the overall system tends to become rather complicated. Some readers don't mind this at all but to others it become the proverbial "last straw."

Fortunately there are a few pickups available, notably crystal types, with sufficient output on signal peaks to load up a sensitive power amplifier valve. The scheme was first suggested in the One Valve Gramophone in December, 1941, and it has been used very successfully since then. With the release of smaller valves and components it becomes possible to obtain even better results from an amplifier only half the original size—an ideal set-up for the enthusiast who wants good average results without a lot of complexity.

As for the quality, we'll back it against a lot of the five-valve radiograms which are on sale today in such numbers. A crystal pickup, which is more or less a necessity, has a better general balance than the conventional magnetic and is generally easier on the records. In fact, with a wide-range crystal pickup and a well-baffled 12-inch speaker the issue should be beyond doubt.

It's hard to believe that so much comes from so little.

CONSTRUCTION

Construction of the amplifier may begin with the mounting of the components on a manufactured chassis or you may decide to bend up a chassis from a piece of scrap aluminium, as was done in the case of our original amplifier.

If so, you will need a piece 9½in x 6in. Cut out the scrap from each of the corners, as shown in the diagram. While a pair of tin snips may be used to do this it is preferable to cut with a fine hacksaw just outside the marked line and file exactly to dimensions with a small file. This avoids distorting the metal.

For the bending operation you will need a vyce and two or three pieces of scrap wood. We suggest that the 6¼-inch sides be bent first. Then bend the flanges which are attached to the ends, taking care to allow for the thickness of the metal. If the corners are drilled 1-16in or 1-8in, as shown on the diagram, it will be very easy to bend the ends into position. Place a piece of wood about 2½ inches wide in position between the flanges, however, to ensure a good sharp bend.

Since there are no large holes to distort during the bending operation it does not much matter whether the holes are drilled before or after bending. The holes as shown on the diagram will be correct in most cases, but it may be worthwhile to check before drilling in case you happen to have slightly different components.

INITIAL PLANS

Probably the best plan is to draw the whole chassis full size on a sheet of paper. After any modifications have been made the corner points and all holes may be lightly centre-punched through the paper to the metal, where the lines can be filled in with a scriber and the holes marked with a pair of dividers.

We find 18-gauge half-hard aluminium convenient for chassis of this size. However, you can use 16-gauge aluminium or a lighter sheet steel if you wish. Steel will require a couple of coats of enamel to prevent rust. Aluminium does not require any protective finish, but fingermarks and scratches will be less obvious if it is given a matt finish by sanding. A better job will result if the sanding is done with wet paper and before cutting.

First components to be mounted on the chassis are the grommets for the power cord, the power transformer and the filter choke leads, together with the valve and speaker sockets and terminals. The 6X4 requires a miniature seven-pin socket, while the 6M5 takes a miniature nine-pin socket.

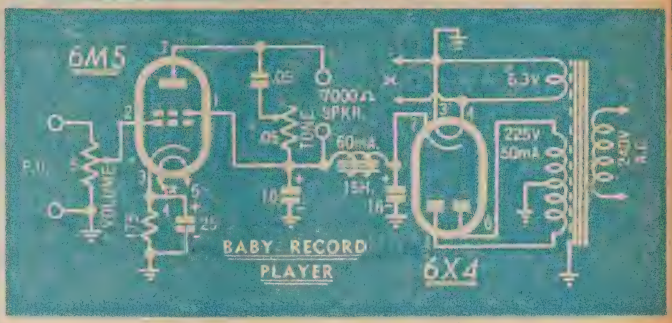
POWER SUPPLY

Bolt the power transformer and choke in place. It will then be possible to complete most of the wiring. The filament wiring, the wiring from the output valve to the speaker socket, and the leads to the choke can best be run in twisted pair. This stays firmly in position and tends to look neater than odd wires run in scramble fashion.

Twisted pair can be prepared from ordinary hookup wire by twisting with a pencil. The method works particularly well with plastic hookup wire.

The power transformer will normally be fitted with an electrostatic shield. This is brought out with a

CIRCUIT OF THE AMPLIFIER



Note that not all the valve pins are used. Type 6AQ5 may be substituted for the 6M5 if desired but the gain is slightly lower. In this case, change the cathode bias resistor to 250 ohms.

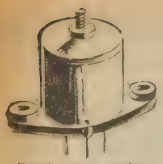
PARTS LIST

LARGE COMPONENTS
1 Chassis 6½" x 2¾" x 1⅝"
1 Power transformer 225V at 50 mA 6.3V. 2A.
1 Choke 15 Henry, 60mA.

VALVES
1 6M5 and 1 6X4

SMALL COMPONENTS
1 175 ohm resistor
1 .5 megohm potentiometer
1 .05 megohm potentiometer
1 .25mfd 40 P.V. condenser
2 16mfd 525 P.V. condenser

SUNDRIES
1 9-pin miniature socket, 1 7-pin miniature socket, miniature speaker plug with socket, 4 rubber grommets, tag strip, solder lugs, hook-up wire, spaghetti, 2 terminals, 2 knobs, approx. 15 6" nuts and bolts, length power flex, power plug etc.



Dual-wave units.

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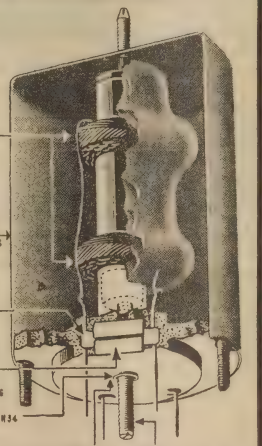

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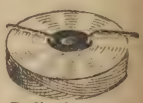

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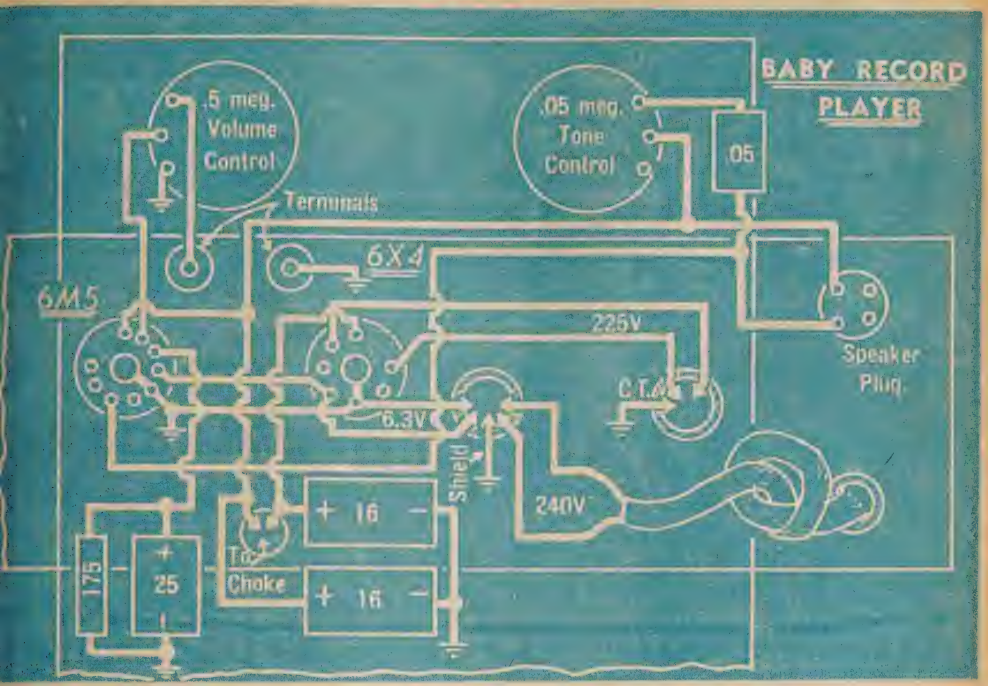
WIRING DIAGRAM OF BABY RECORD PLAYER



The wiring diagram is not to scale nor are all the components in their exact positions. However, it clearly shows all the connections and should be of great assistance to those not confident about reading the schematic circuit.

ne single lead and is usually easily stinguished from the supply leads. rth the electrostatic shield to the assis. A number of solder lugs can distributed around the chassis ndy to the various earth points. If e chassis is made of steel it will be cessary to run a tinned connecting ad around the various lugs to en- re good connections.

At this point the power cord can installed. The leads from the ansformer join the power cord at a g strip mounted on the side of the assis. Take great care that there no possibility of the bare power ads touching the chassis or the ntre earthed lug, as this could result a dangerous shock. Tie a knot in e cork inside the chassis, so that cidental tension on the cord will t be concentrated on the tag strip.

The two potentiometers can now be stalled, together with the several nall components and remaining con- cting leads. None of the compon- ts are critical with regard to their acement, so it is simply a matter soldering them neatly and firmly.

IRCUIT CHECK

The valve socket numbers are own on the circuit. Viewed from derneath, the pin numbers are unted around in a clockwise direc- on. Hold the valve, base up, and with the spaced pins toward you. Pin 1 is then the first pin on the left.

There is no need to use shielded wire, since the high impedance audio leads are very short.

Before connecting the amplifier to the power mains check carefully through the circuit to make sure that everything is in order. Plug in the 6M5 and switch the power on. Inspection of the cathode will at least indicate whether or not the filament circuit is in order.

TESTING

If so, plug in the 6X4 and speaker and switch the power on again. Do not forget the speaker, otherwise the 6M5 may be severely damaged.

If there is any indication of blue sparks in the 6X4 or its plates (not the cathode) glow red, switch off immediately and look for a shorted high tension supply. It is possible that a faulty electrolytic condenser could cause a short or partial short, quite apart from the wiring. Incidentally, note that electrolytic condensers have a definite polarity and will not work when reversed. Red usually indicates positive.

If everything is in order, there will be a loud squeal or hum in the speaker when the "hot" input terminal is touched with the volume control turned full on.

Both valves normally work at quite a high temperature, and cannot comfortably be touched with the fingers. They are made with special glass, which is designed to withstand the heat without softening.

Having successfully completed the amplifier, it remains to choose a pickup and speaker.

Most crystal pickups are suitable for use with an amplifier of this type, provided they are of fairly recent design. Crystal pickups in general have a natural rising bass characteristic and designers generally try to adjust this natural characteristic to compensate for the falling bass characteristic of standard recordings. The frequency range generally extends from about 50 to 7000 cycles/sec., which is adequate for quite good fidelity.

NEEDLES

The output of most crystal pickups is in the order of from 1 to 2 volts when checked with standard frequency recordings. The average classical or swing record will have peaks which will increase the output considerably beyond this and in many cases make it possible to drive the power valve to overload with the volume control turned full on.

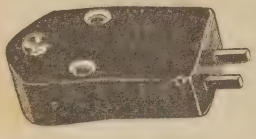
Pickups of the type we have in

A MAGNETIC HIGH FIDELITY CARTRIDGE

to replace CRYSTAL CARTRIDGES

PLAYS STANDARD AND LONG PLAYING RECORDS

Goldring



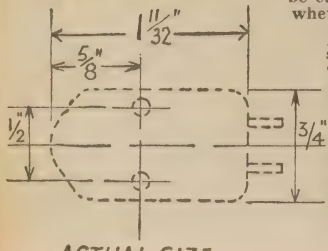
A new Magnetic Cartridge supplied with 2 sapphires, one to play standard and the other for Microgroove records, will be available to owners of pick-ups using the American standard ½in. centres for screwing crystal cartridges to the pickup arm.

THIS COVERS PRACTICALLY ALL AMERICAN, AUSTRALIAN AND ENGLISH CRYSTAL PICKUPS.

THE "GOLDRING" MAGNETIC CARTRIDGE No. 150 is a really high-class reproducing unit with a frequency range from 30 to 16 thousand cycles and a surprisingly high output in relation to its quality.

The weight of it is only 14grms., and it combines durability, true high-fidelity reproduction, high output and easy stylus changing when playing standard or Microgroove recordings alternatively.

The overall size is only 1 11-32 x ¾ x 7-16in. The sketch below, which can be cut out and placed into your pickup arm, will make sure beyond doubt whether it will fit your pickup arm.

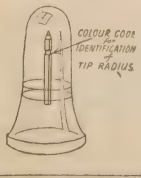


ACTUAL SIZE

Cut out on dotted line to make sure cartridge will fit your pickup arm.

DAMPING: One of the unique features of this cartridge is the following: The stylus is at the same time the armature and is embedded in a non-ageing damping system. It is very light and rigid and weighs less than 0.1grm. In addition, the special damping and suspension system allows the stylus to move freely in all directions and the sapphire can find its correct position and automatically eliminate the residual tracking error inherent in most pickup arms. As a result, wave form and transient response are exceptionally good.

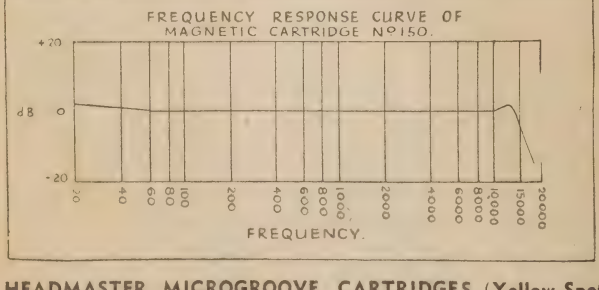
CHANGING OF STYLUS: The stylus of the Magnetic Cartridge can be withdrawn with two fingers without the use of tools and another stylus inserted in two seconds. While we advise, in the case of heavier pickups, against removing sapphire needles before they are worn, exhaustive tests have shown that frequent changes of the stylus in the Magnetic Cartridges No. 150 will prolong the life of the sapphire point by about four times. The reason is that wear of the sapphire in a very light pickup takes place gradually and frequent taking out and putting in of a stylus will keep the point round without allowing the record wearing flat to develop



STYLI: All styli are colour-coded and the cartridges are being supplied with the blue stylus with a tip radius of .003 thou. for standard recordings, and the yellow stylus with a tip radius of .001 thou. for microgroove recordings. Also available are green style with a tip radius of.0025 and orange style .0035 thou. Price of these, as well as all replacement styli, is 15/-.

WEIGHT ADJUSTMENT: It is up to the ingenuity of the user to provide the necessary weight adjustment, that is, playing standard recordings as nearly as possible with 14grm needle pressure and Microgroove recordings with. 7grm. Experience shows that most users will not find it difficult to fit springs between arm and pedestal to provide this adjustment.

PRICE OF MAGNETIC CARTRIDGE No. 150: Complete with two sapphire styli, 63/-.



SPECIFICATION

Output (at 3.16 cms/sec. RMS velocity)	150 millivolts
Frequency Range	30-16,000 cps.
Stylus pressure 78 RPM	14grm.
33 1-3, 45 RPM	7grm
Coil impedance (at 1,000 cps).	3,000 ohms
Coil resistance	2,000 ohms
Optimum load	50,000 ohms
Cartridge fixing, standard ½-inch centres.	
Cartridge weight	14grm.

HEADMASTER MICROGROOVE CARTRIDGES (Yellow Spot): These are available in small quantities. Please book your order with your usual supplier to avoid disappointment. Price, 35/-.

THE CIRCUIT OF A RECOMMENDED PRE-AMPLIFIER WILL BE SUPPLIED with EACH CARTRIDGE

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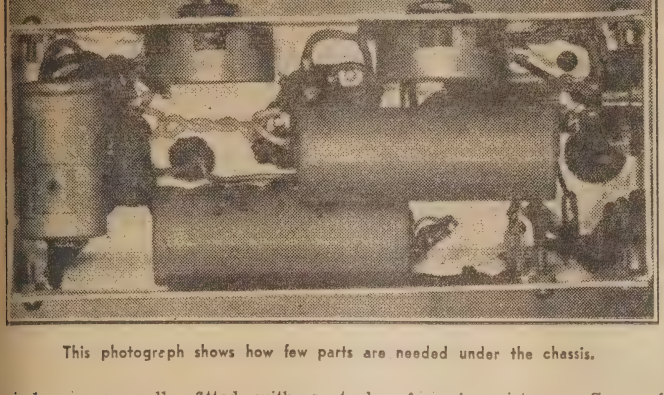
UNDERNEATH THE CHASSIS



This photograph shows how few parts are needed under the chassis.

mind are generally fitted with a needle chuck and either standard steel or sapphire tipped needles may be used. If you decide to use steel needles, choose the loud-tone types, so that there will be a reserve of gain if required. Of the sapphire types, the bent-shank needle is a good choice, since it is less likely to be damaged by a chipped record if the needle pressure is high, as it may be with some of the older types.

At least two lightweight, permanent-needle type pickups are available at the present time. They are the Acos GP12 and GP20. The output is slightly less than for the conventional crystal types, but considerably greater than in the case of magnetic pickups.

Apart from eliminating the obvious nuisance of having to change the needle at the end of every record, the lightweight permanent needle causes less record wear. It is also less likely to cause distortion because it fits the shape of the grooves better.

Of the two pickups, the GP20 is the lighter and causes less record wear. Its frequency response also extends higher up the spectrum. This may make the extra cost of the GP20 a good investment if you feel that you may possibly wish to experiment with some more elaborate equipment at a later date. It has a replaceable head and microgroove replacements are available if required.

The output is both pickups is of the same order.

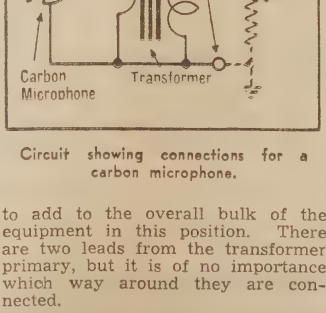
MAGNETIC PICKUPS

Although ordinary magnetic type pickups can be used, they are not likely to be very satisfactory with this amplifier. The output is considerably lower than that of the crystal types, and even the high gain 6M5 requires a preamplifier valve before full output can be realised. Furthermore, the rising bass characteristic is absent and the small amount of bass compensation introduced by arm resonance is not likely to be of much assistance. Some of these pickups are notorious for their stiff suspension and hence the damage they cause to the sides of the record grooves. For this reason alone, ordinary magnetic pickups are best avoided.

Lightweight magnetic and needle armature pickups have very low output, and are therefore not of any interest in this particular case.

The remaining essential auxiliary is a speaker. It must be a permanent magnet type and ideally should present a load of 7000 ohms to the power amplifier valve. However, the valve will work quite well with any load between about 5000 and 10,000 ohms.

Since the voice coil impedance of speakers is quite low, a transformer is necessary to reflect the correct impedance to the valve. We decided to mount this transformer on the speaker, rather than the amplifier itself, since it is less likely



Circuit showing connections for a carbon microphone.

to add to the overall bulk of the equipment in this position. There are two leads from the transformer primary, but it is of no importance which way around they are connected.

If you desire to keep the speaker assembly as compact as possible, we would suggest from a 5 to an 8-inch speaker. A 3-inch speaker certainly saves a great deal of space, but the results are likely to be ex-

tremely disappointing. For best results a large speaker is desirable.

A medium-priced 12-inch speaker mounted on a large baffle board, is quite a good proposition, but if you are able to install it in a vented enclosure, the results will be even more worth while. The average 12-inch speaker will require the enclosure to have a volume of about six cubic feet. The placement of the vent is not critical, but it should have an area of about .8 of the speaker cone area.

Results at the bass end are improved since the resonance of the enclosure tends to oppose the resonance of the cone and smooth the frequency response curve. If you can line the interior of the enclosure with canite, thick felt or some other sound-absorbing material, the resonance effects will be even less sharp with a further improvement in results. Do not forget to allow for the volume taken by the sound-absorbing material.

If you do not wish to undertake this elaboration, the speaker coud be mounted on a fire screen or in a bookcase, but do not mount it in a small sealed compartment. If you employ the bookcase suggestion, make sure that there is a vent somewhere where the pressure waves from the back of the cone can escape.

Apart from its primary function of reproducing gramophone records, it occurred to us that the little amplifier might be useful for microphone work. Accordingly, we conducted some experiments along these lines.

There is plenty of gain to operate a carbon microphone. A transformer is required, together with an exciting battery. We have included a suitable circuit. If you can obtain a transformer designed to work with a carbon microphone, so much the better, but we found that the results were quite acceptable with an ordinary speaker transformer worked back-to-front. A single 1.5 volt cell will be all that is required in the way of exciting voltage, but 3.0 volts may be used if extra gain is required. It is a good idea to arrange a press-to-talk switch on the microphone, so that the battery is not wasting when not actually being used.

CARBON MICROPHONE

The quality of the carbon microphone, although perfectly intelligible, is not particularly good by modern standards. The harmonic distortion is high, the frequency range limited and sharp peaks within the range tend to make it sound rather "tinny."

Under close talking conditions, a small permanent magnet speaker makes quite a good microphone, and when fed in to our little amplifier is capable of giving good speech reinforcement. Use a speaker fitted with a high impedance transformer if possible. A 5000 ohm speaker will work, but if you can obtain one reflecting 30,000 ohms, so much the better. The quality is quite smooth and compares with specialised microphones.

Running expenses of the amplifier are quite low, since the power taken from the mains is only a few watts.

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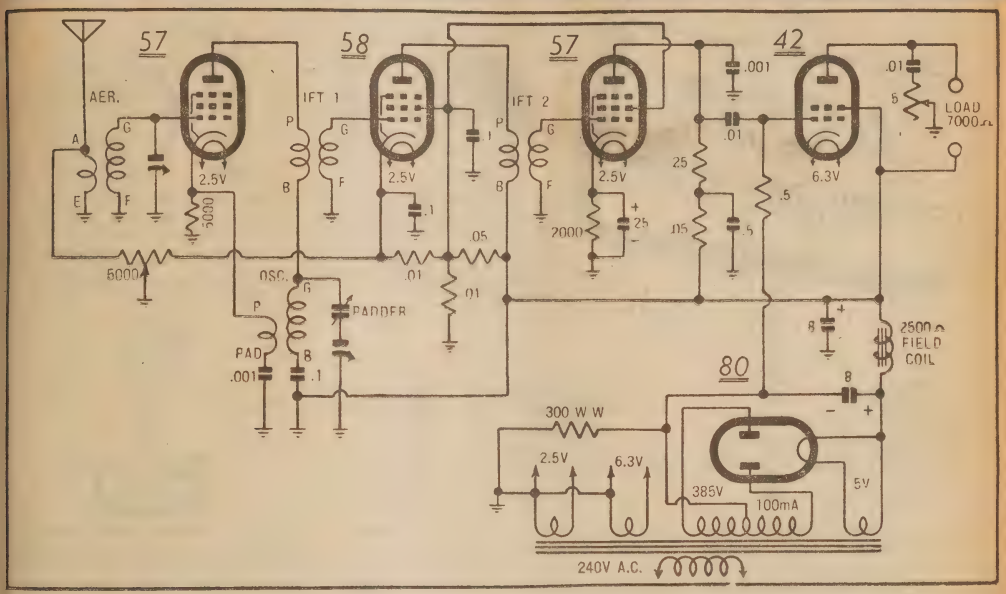

An autodyne superhet circuit from a reader in Coburg, Vic. Though apparently conventional at first glance, there are points of error.

Our comments this month are directed at two circuit designs submitted by readers in Victoria. The first is from Coburg and the second from Horsham. As you will see both readers have been tripped up by tricky points and our analysis of their efforts should assist not only the two readers concerned but many other budding designers.

THE first design, from the reader in Coburg, was accompanied by the remarks: "For use with odd valves and pieces . . . ." In general, the effort wasn't too bad.

However, before treating the design stage by stage, let's put matters right about the suppressor grid in each of the first three valves. In types 57 and 58, the suppressor grid is brought out through a separate pin on the base, pin No. 4 to be exact, and consequently require external connection to the cathode. Possibly this was an oversight.

THREE ERRORS

The first stage boasts of three errors, although each could be just plain drawing errors. In the first case, the screen has been left floating and lacks the rather necessary 100 odd volts. The normal practice in such a circuit is to tie together the screens of the first three valves, provide a common bypass of about 0.1 mfd., and feed with about 100 volts obtained by dividing down the HT voltage.

The other point is that the HT line, supposedly feeding the converter stage, has been taken to the wrong side of the 0.1 mfd. bypass. This should have been taken to the other side of the condenser, otherwise the power supply, and particularly the rectifier, would be in for some rough treatment.

The third point is that the identification of the connections to the bottom ends of the two windings of the oscillator coil should be reversed.

In the IF stage a rather important component is omitted, namely, a limiting resistor between the volume control line and the cathode. A value of 300 ohms would be just about right. This sets the minimum bias figure for the valve when the volume control is advanced to the "full on" position.

The voltage divider network associated with this control and the screen feed to the IF and detector valves could well be rearranged, not only to provide a better control over the volume, but also to supply something like the correct screen voltage to these valves. The unconnected screen of the autodyne converter could also be brought into the picture here.

The usual set-up in this part of the circuit is to use a 0.025 meg. (25,000 ohms) voltage divider connected from the HT line to one side of the 5000 ohm volume control. A tapping of 100 volts is made to supply the common connection of the screens of the valves in question. The idea of returning the voltage divider to chassis via the volume control is to provide sufficient voltage drop across this control, about 35 volts, to cut the valve off when all of the resistance is in circuit. Cathode current of the valve alone could not provide this control voltage.

With the arrangement as shown, the maximum controlling voltage available for the valve will only be about 10 volts. Furthermore, the voltage supplied to the screens would be under 30 volts. Rearrangement with a voltage divider as suggested would be a simple way out, although fixed resistors could be used.

SECOND DETECTOR

Coming to the second detector, which is an anode-bend type, the value of the cathode resistor is too low for the purpose and should be increased to 0.01 meg or 0.02 meg. Another point is that this resistor should be bypassed for RF, with a 0.1 mfd. The 25 mfd. audio fre-

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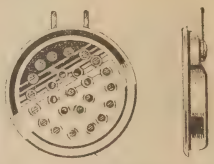

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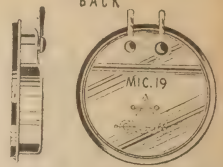

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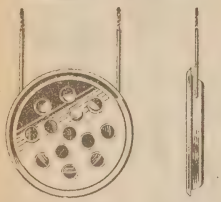

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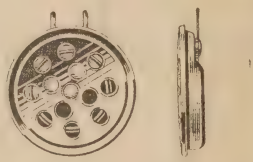

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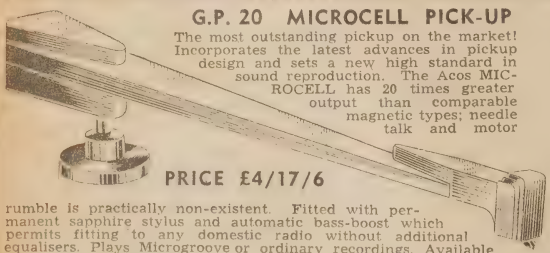

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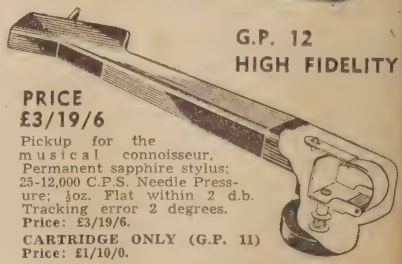

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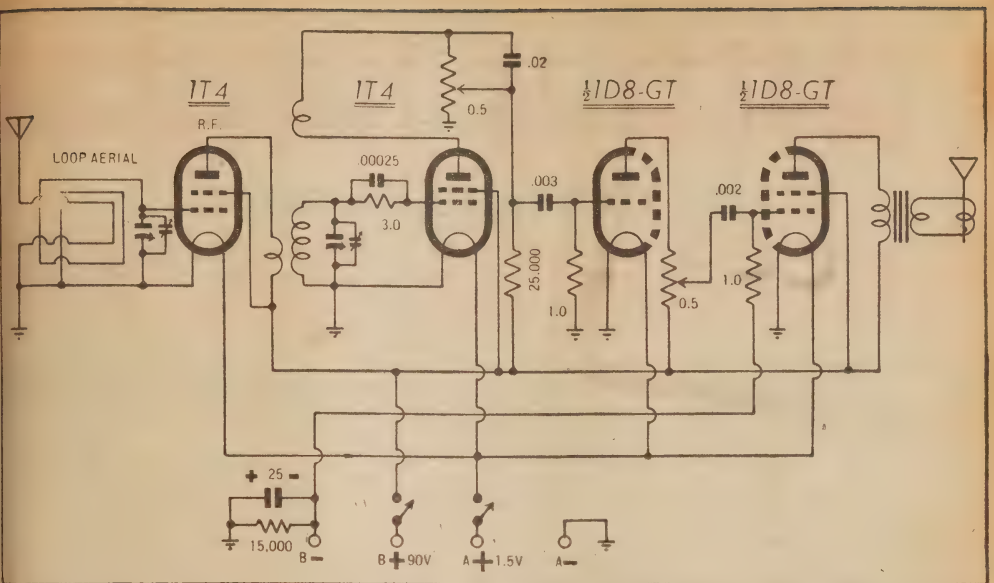


And here is a battery set from our Horsham reader. See if you can pick any errors before reading the article.

uency bypass is optional in many ases, the main advantage to be ained being a possible improve- ent in bass response, provided that ne quality of the speaker trans- ormer and the speaker allows such nprovement to be noticed.

The RF bypass at the plate of this alve is too large. A value of .0005 nfd would be the upper limit.

Plate load decoupling in this stage s a good point, although it would e better, in the interests of hum eduction, to use, say, an 8 mfd. lectrolytic in place of the 0.5 mfd.

In the output stage, the cathode f the valve is a rather important lement and, in this circuit, should e connected to chassis. This is robably just a drawing error.

With regard to the tone control, is usual to connect it between late and screen. The effect is still ne same, but the point is that the -c voltage across the components s considerably reduced. More suit- ble values for the potentiometer nd capacitor are 0.05 meg. and 0.05 nfd., respectively, although 0.01 meg. nd 0.01 mfd. would still work.

RANSFORMER RATING

Lastly, the power transformer cur- ent rating is unnecessarily large, nd an 80 mA. rating would be ade- uate. However, it is necessary to atch the dissipation of the field oil, the actual field excitation re- uirements depending upon the size f the speaker. With this set, the dis- ipation will approach 9 watts. So nuch, then, for the first circuit.

In regard to the second circuit, he two points which struck us mmediately were the high value of he back-bias resistor and the screen oltage on the 1T4 valves. But first f all, the bias resistor:

The initial step is to tally up the otal high tension current of the set. he 1T4 I.F. tube will draw approxi- mately 5 mA, representing the total plate and screen current.

The 1T4 detector and triode por- tion of the 1D8-GT will draw very little current, due to the load re- sistors in the plate circuits.

The 1D8 pentode draws 5 mA for the plate and 1 mA for the screen, a total of 6, which, with approxi- mately 5 mA for the rest of the set, gives 11 mA in all.

BIAS FOR 1D8

The bias required for the 1D8 is 9 volts, which is to be developed across the bias resistor by the total high tension current flowing through it. Its value may, therefore, be calcu- lated from the Ohms law formula, R equals E/I, where E is 9 volts and I is .011 amp. So R equals 9/.011 or 9000/11, which equals 818 ohms. This is not an exact commercial value and the nearest available would have to be used.

Since minimum current consump- tion is always important in a battery set, the bias value is often increased and a resistor used which is on the high side of the calculated value. A logical choice would be 1000 ohms, the extra bias saving battery drain, but also reducing the maximum power available. This may not matter much in practice.

Now, to get the 1T4 screens straightened out. The R.F. stage needs a dropping resistor of approxi- mately 0.02 megohms and a screen by- pass condenser of 0.1 mfd.

A further reduction in battery drain is possible if the R.F. screen voltage is reduced below the 67.5 volt maximum. This will reduce the gain of the stage, but a considerable saving in current is often possible before this becomes serious. For ex- ample, the tube will only suffer small reduction in gain when the screen voltage is reduced to 45, but the current drops from 5 mA to 2.5 mA. The dropping resistor to achieve this is around 0.04 megohms.

Of course, the reduction in total receiver current calls for an increase in the back-bias resistor, the mini- mum value now being 1100 ohms, and the suggested value 1500 ohms.

The plate load of 0.025 megohms for a pentode detector is rather on the low side, and if the full gain of the valve is to be realised we would suggest at least 0.1 megohms. Some experiment is possible here, since this value will have a bearing on the reaction circuit.

This, naturally, brings us to a consideration of the reaction circuit, which, while probably workable, does appear to have some unfavor- able features. Unless the circuit is regarded purely as a basis for ex- periment, we would suggest a more conventional arrangement.

VARIOUS METHODS

One method is to wire the potentio- meter as a voltage divider, one end connecting to chassis, the other end to high tension, and the moving arm to screen. The screen should be by- passed with about a 0.1 mfd.

The top end of the plate load resistor connects to the reaction winding, and this junction is by- passed to chassis by a small mica condenser of about .0005 mfd.

Finally, there are two objections to the present position of the volume control. First, a plate circuit is not the best place for a potentiometer as the current flow frequently causes noisy adjustment. Second point is that the control is unable to protect the first audio stage (1D8 triode) from overload on strong signals. If the control is fitted in the grid circuit of the 1D8 triode, both of these objections are overcome and a much more satisfactory control system results.

A COURSE IN TELEVISION

PART 15—VIDEO AMPLIFIERS

Next step in the study of television receiver design is to discuss the general subject of video amplifiers. While they may be compared in general to the audio amplifier in a conventional broadcast receiver, there are many points of difference, the chief one being the need for an extremely wide frequency response.

BY way of definition, the video circuits in a television receiver are those which are concerned with the picture signals, following the detector and up to the point of application to the intensity grid of the picture tube.

Considerations which govern the required amount of video amplification can be compared with those which apply in a broadcast receiver.

Many small mantel sets, of familiar design, dispense with audio voltage amplifier stages and feed the detector output straight to the grid of the power valve. The scheme works quite well, provided there is a good signal level at the detector and provided that a sensitive output valve is employed.

However, where the initial design calls for added gain and improved fidelity, at least one voltage amplifier stage is employed, allowing the designer a wider choice of output valves and admitting of improved circuitry.

In just the same way, it is possible to design a television receiver such that the detector output feeds directly into the picture tube grid, thus eliminating video stages altogether. While remaining a perfectly practical scheme and an aid to cheapness, it must obviously restrict the choice of detector circuit and also of picture tube.

Thus, where a receiver is not built down to a price, the designer may elect to include a number of video stages, according to his ideas and requirements.

DESIGN FACTORS

In settling on the ultimate design of the video channel, various factors have to be considered and the more important ones are discussed in the following paragraphs.

One has already been mentioned, namely the polarity of the signal which is ultimately impressed on the picture tube grid. The output from the detector rises or falls with increased illumination according to the type of modulation, while it is negative—or positive—going in respect to earth according to the polarity of the detector connection.

The phase of the resulting signal is normally rotated by 180 degrees in each video amplifier, being restored to the original phase if passed through an even number of stages. The designer must therefore bear these factors in mind and so arrange matters so that what is intended to be a white signal from the transmitter shall appear at the picture tube grid as positive-going pulse. Alternatively, it could be fed as a negative-going pulse into the picture tube cathode.

If this requirement is not met a negative rather than a positive image is produced on the tube screen.

A second point also has been mentioned, namely the d-c component of the signal. Failure to preserve this component tends to produce an average overall illumination for all scenes. This is not only undesirable in the dramatic sense, but most disturbing to the eye, because of its close relationship to detail and contrast.

The only way to preserve the d-c component would be to employ direct coupling between the detector, the video stages and the picture tube input. However, while not impossible, it is generally very difficult to arrange a progression of voltages over several stages such that each one operates under optimum conditions.

MUTUAL EFFECTS

A further point is that, in any direct coupled system, the failure of one component or even a variation in value can react along the chain to completely upset its operation and possible to cause overload and damage to the picture tube.

The usual course, therefore is to employ resistance-capacitance coupling throughout the video channel and to create new and artificial d-c component at the picture tube grid by means of a d-c restoration circuit.

An audio amplifier terminates normally with a power amplifier, which is operated under conditions such that it delivers the required amount of power across a selected and optimum load.

In a video system, the amplified output is normally applied to a control "grid" in the picture tube, so that the emphasis is on volts rather than watts. The measure of a valve's usefulness in a video amplifier is its ability to develop the required signal voltage across a load resistor and over an extremely wide band of frequencies.

Distortion must be considered also in the design of a video chain, but the emphasis is different from an audio system. In the latter case, it is most important to avoid non-linearity in the amplifiers or, in other words, the generation of harmonics which are very objectionable to the ear.

On the other hand, the ear does not appear to be at all critical about phase relationships existing between notes of different pitch. In the normal way it is able to hear them quite separately and it matters little if reactive components in the amplifier chain cause a slight lag in the phase of high frequency tones, relative to the low frequency tones.

VIDEO SIGNALS

With video signals, just the reverse is the case. The eye is not offended by the results of moderate non-linearity in the system, which tends to modify the light and shade pattern. It is, however, most critical of phase shift, which delays the reproduction of high frequency signal impulses and causes a displacement of detail.

The effect is particularly noticeable in sections of the picture which involve an abrupt change from black to white, the sharp line being replaced by a greyish blur, or even a "ghost," as if the image were out of focus. In other words, it is highly important to maintain the exact shape of the modulating envelope and therefore the original phase relationship of all its component frequencies.

One might draw a parallel with the reactions of a patron at a symphony concert. The phase of sound waves arriving from a hundred instruments is purely a random affair depending on the individual accuracy of pitch, the effect of echoes and reflections, the distance from the listener's ears—yes, and even the tilt of the head, as the listener peers past the tall man in front!

Nor is the eye critical of the exact distribution of light and shade across the scene—that largely is the result of the floods and spotlights. But let the player's fingers disappear into a blur and the bow ties be smudged across the shirt fronts and our patron becomes aware that all is not well.

The matter of phase distortion is intimately related with overall frequency response, more or less the same factors governing both.

At the low frequency end, it is usual to consider that the respons

of the video channel should be sustained down to the picture frequency, which is about 25 or 30 c/s, according to the accepted standards.

At the other end of the scale, the response must be maintained up to extreme limits, for reasons which were explained early in the series. As a general guide, the video channel for the British standards must handle all frequencies up to about 2.5 Mc, for the American system about 4 Mc and upwards of 5 Mc for the probable Australian standards.

FREQUENCY CONTENT

In other words, the mere video content of a television picture extends in frequency from well down in the audio range right through the broadcast band and up into the short-wave spectrum.

Failure to observe these basic requirements must mean, inevitably, that the signal applied to the picture tube grid will not contain the full intelligence of the original camera impulses.

In actual practice, an upper limit to picture detail is set by the line structure of the picture and by the focusing qualities of the picture tube. Therefore, while the designer must recognise basic requirements, it is futile to achieve a finesse in the electrical circuits which cannot be matched or reproduced on the tube face. As a result, certain compromises are permissible, particularly in the cheaper sets with small picture tubes.

Getting on to the actual circuitry of video amplifiers, it can be assumed, more or less as a matter of course, that transformer or impedance coupling is completely out of the question. It is difficult enough to make components to produce level response up to 6 or 7 Kc without trying to handle as many megacycles. Therefore, the design problem is restricted immediately to direct or to resistance-capacitance coupling.

L.F. RESPONSE

Direct coupling has the inherent advantage of good low frequency response, even to the extent of preserving the d-c component of the signal. However, certain limitations imposed by cathode, screen and high tension bypass condensers still remain, while high frequency losses are much the same as with a resistance-coupled system.

Since the latter obviates the difficulties associated with interlocked operating voltages, it is generally preferred.

A resistance-coupled audio stage usually exhibits a fairly level response from about 30 to 10,000 c/s with a taper at each end, depending entirely on design detail. However, this or something slightly better is all that is required of an audio stage, and what happens to the response beyond audible limits is of little or no consequence.

For video work it is necessary to identify and eliminate all causes of loss at the high frequency end, so that the response is extended up to several megacycles, according to the requirements of the system. Care is necessary also to ensure that any steps taken with this object in view do not adversely affect the low frequency response.

The whole subject of high frequency response is sufficiently involved to warrant separate treatment next month, so that the remaining space here can be devoted to a discussion of the low frequency end of the spectrum.

Figure 1 shows the basic circuit of a resistance-coupled stage, which has been represented as a pentode to include all relevant factors.

The first component to consider is the bias resistor Rk. The effect of the plate (and screen) current flowing through this resistor is to make the cathode positive with respect to the grid return, which is the same thing as placing a negative bias on the grid with respect to cathode.

CATHODE CIRCUIT

However, a complication arises in that fluctuations of plate current at signal frequency tend to develop a signal voltage across the cathode circuit, which tends to counter the original grid signal and reduce the effective gain of the stage.

For example, if the grid swings 1-volt positive at a particular instant, the accompanying increase in plate current will increase the cathode voltage by, say, 0.5 volt. The effective difference in signal potential between the grid and cathode is therefore reduced to 1.0 minus 0.5, equals 0.5 volt, and the gain of the stage is less than it would be if the degenerative effect were not present. In practice, the difference is usually about 2.1, representing a loss of 6 db.

The normal procedure is to bypass the resistor with a condenser Ck, of such a value that it reduces the impedance of the cathode circuit to a comparatively small figure at all frequencies which the stage must amplify without loss. In other words, the reactance of Ck must be considerably lower than the resistance of Rk in ohms over the desired range.

This is no great problem where the resistance of Rk is several thousand ohms, but it becomes a different proposition should the choice of valve and operating conditions reduce Rk to a few hundred ohms. At 300 c/s, even a 25 mfd. electrolytic has a reactance of 212 ohms. Apart from possible loss of gain, the matter of phase shift has also to be considered.

Quite frequently designers adopt the alternative course of omitting Ck altogether so that the loss of gain is the same at all frequencies, the cathode feedback having the additional effect in some cases of reducing phase and frequency distortion, just as it does in audio systems.

SCREEN BYPASS

In the screen circuit, it is also necessary to select carefully the value of the bypass condenser, too small a condenser allowing the screen potential to vary with low signal frequencies and to produce loss of gain and phase shift. As a rule, the value of the screen supply resistor Rs is fairly high, and it is possible to use a large, but otherwise convenient and large value for Cs.

A major source of low frequency loss in any R/C system is the value of the coupling condenser to the following stage. It can be shown that the response will be down 3 db on the mid-frequency gain at a frequency such that

$$F = \frac{1}{2 \text{ pi } Cc \text{ (R plus Rg)}}$$

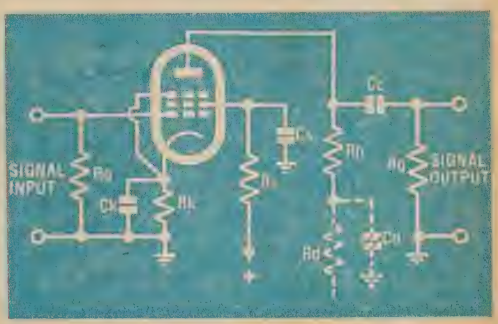
Where the quantities are in cycles, farads and ohms and "R" is the parallel resultant of the plate load Rp and the valve's plate resistance.

For good low frequency response it is obvious that either Cc or the R quantities must be high, in order that F will be low. If the choice of valves and conditions sets a low limit on Rg particularly, then Cc must be increased to a large value.

Sometimes the requirement can be satisfied without complication, but in other cases there may be special difficulties. By way of example, large coupling condensers are expensive, particularly if they are to exhibit low leakage and offer a good safety margin against breakdown. Again, large coupling condensers exhibit increased stray capacitance to the chassis and other wiring, which may militate against the high frequency response.

Very obviously, then, careful thought must be given to the coup-

(Continued on Page 102.)



Illustrating the basic circuit of a resistance coupled amplifier. The article explains the components and values which govern the low frequency response.

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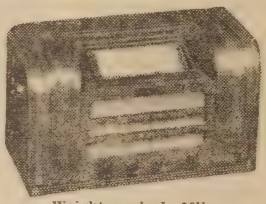

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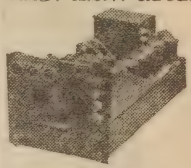

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Suitable with minor alterations for conversion to F.M. Band (88-108 mcs.). Television Band (175-200 mcs.), 144 or 288 mcs. amateur bands.
Complete with valves as above in vented metal case, size, 7½ x 8½ x 18 inches.
Price, F.O.R. **£8/15/-**

4W FLUORESCENT LAMPS

Colour: Blue. Length, 5½ inches. Ideal R.F. indicators.
Price, each **2/6**
Per doz. **25/-**
Packing and postage 6d each.

TWIN METER CONTROL UNIT

Comprising: imported inch flus mountin meters, 0- mA., D.C. an 20V D.C.; 7,500 ohm po tentiometer 7 position amp. rotar switch; S.P S.T. toggl switch; plug sockets, shoc mounts, etc.
Price, ea. **37/6**
Packing an Registere
Postage, N.S.W., 1/9; Qld., Tas., Vic 2/9; S.A., W.A., N.T., 3/9.

METERS

0-30 mA. D.C. 3-inch round flush	25/
0-30 volt D.C. 3-inch round flush with datum indicator	30/
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0-3 Amp. R.F. thermocouple. New Imported 2" square flush	17/
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20 mA. D.C. 300 amp. scale, 3in. round flush	25/
20 volt D.C. 2in. square flush, imported	20/
40 volt D.C. 2in. square flush, imported	20/
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20 volt and 200 volt D.C. 2in. round dual reading with leads	20/

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24 volt 60 amp. D.C. (F.O.R.). Each **£11/10/-**
12 volt 60 amp. D.C. (F.O.R.). Each **£9/10/-**
Ideal for home lighting plants, battery charging, plating, etc.

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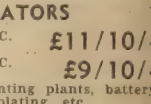
5-pole each 2 pair of contacts. Made in U.S.A. Ideal for receivers, multimeters, etc.
Price, each **12/6**
Packing & Postage N.S.W., 9d; Interstate, 1/6.



ELECTRONIC EQUIPMENT CO.

Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

LM3555—29b West St., Lewisham, Sydney OPP. END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) **LM3555**

PICKUP FOR THE SIMPLE SUPER

The Simplified Superhet, described in detail last month, can readily be used with a motor and pickup to make a complete and inexpensive radiogram. With the aid of the diagrams below, no one should have any difficulty in sorting out the necessary connections.

By RAYMOND HOWE

THE wiring, of course related particularly to the Simplified Superhet—or Radio and Hobbies Kit No. 1—but the terminal arrangement is similar to that used in a good few commercial receivers.

We can assume that the set and the speaker are already fitted into the cabinet and that there is a place waiting for the turntable and motor.

The next step is to lay out on the motor board all the necessary bits and pieces including the turntable, the pick-up with its arm-rest, possibly two needle cups and the switches to control the set and turntable motor. Position all these items to give a neat layout and mark their positions.

In the case of the turntable, fix the position of its centre by measurement from the sides of the cabinet and then lay the motor cut-out template over this spot. These templates are usually supplied with the motor.

It is now merely a matter of drilling and cutting the motor board and securing everything into position. Be careful, however, when drilling a veneered surface, as it splits easily.

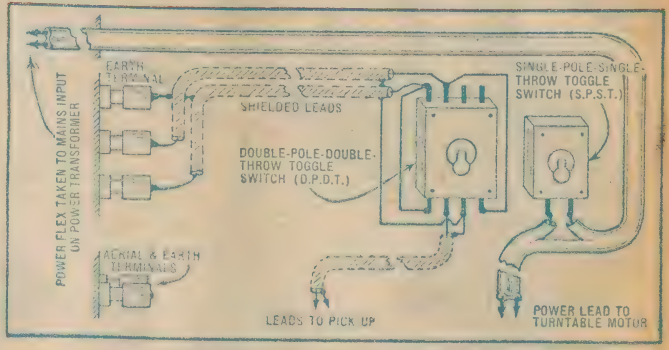
CONNECTING UP

So far so good. Now, with the wiring diagram at hand, squat down at the back of the cabinet and get an idea as to the approximate length of shielded hook-up and power flex required.

We have shown the a-c supply for the motor as being taken from the anchor points which supply the primary winding of the power transformer of the set. It is possibly more convenient to do this than to provide a junction box external to the set. However, please yourself on this point.

If you use the "Nylex" or rubber-covered type of flex, it should be possible to pass both runs through the one grommet at the rear of the chassis. This additional run of flex goes to the motor switch and thence to the motor. In making the connection to the switch, carefully cut one lead of the flex and split the flex for about half an inch each way. Remove the insulation from the cut ends for about 3/8 inch and solder on to the terminals of the smaller toggle switch. The continuation of the flex will connect to the appropriate terminal screws on the motor.

If the motor sports three terminall screws, be careful in your connection as the third one will most likely be marked "Earth" and will connect to the frame of the motor. Where the motor is already provided with flex, there is a good chance that it will be long enough to do the job without being added to. If any extension is found necessary, carefully tape the join. Run some tape also around the terminal lugs of the motor switch "just in case."



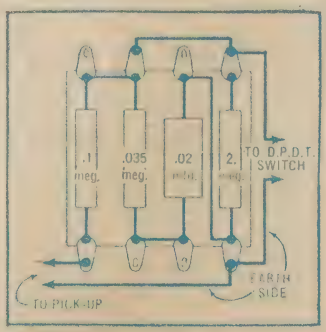
Pictorial diagram of the necessary wiring to connect a pick-up and motor to the Simplified Superhet. The same arrangement applies to many commercial receivers.

In most cases, there is no need to worry about the earthing of the frame of the motor. It is a point to bear in mind, however, if you happen to get hum pick-up from the motor on to the pick-up or leads. If, for this reason, you find earthing necessary, use three-core flex in the run from the motor and switch down to the set and from the set to the power point.

Connect the "earth" wire, which is usually the green wire of the three-core flex, to the frame of the motor and "earth" it to the chassis of the set near where the leads meet inside the set chassis. The green lead of the flex running from the set to the power point is then earthed to the chassis at the set end and to the earth pin of the 3-pin power plug.

Sometimes it is sufficient merely to connect the frame of the motor to the "earth" terminal of the receiver chassis.

Some brands of pick-ups have a switch, arranged in the mounting base and operated by movement of the pick-up arm, which is intended to switch the turntable motor on and off. The switch is normally "off" when the pick-up is at rest on its support.



This simple compensating network can be used with a conventional magnetic pick-up. It increases the bass response but necessitates turning the volume control on further for the same output.

P.U. SWITCH

If you don't want to use this switch, just roll the leads up out of the way. If you do want to use it, connect it to the power flex in exactly the same way as the SPST is shown wired in the wiring diagram. Remember, this switch or any other switch doing the same job, makes and breaks in one lead only of the circuit being switched.

So much then for the motor. Turning to the shielded wiring between the pick-up switch and the set, measure off the appropriate lengths for the two runs.

Prepare the shielded wire by unravelling the braid for about an inch at each end. Remove about a quarter of an inch of the insulation from the inner wire and solder to the appropriate lugs of the DPDT switch. You may find it somewhat easier to re-

ıove the switch temporarily from ıe motor board for the soldering ɔb. Complete the other wiring on ıe switch lugs including the con- ection of the pick-up leads.

Whether the pick-up has shielded able or not, connect as shown in the ɪiring diagram. Some pick-ups have pair of light unshielded leads and doesn't matter which of the two eads connects to the "earth" side.

Note that the braids of the other wo shielded leads and the braid of he pick-up lead (or one of the pick- ps leads if it is unshielded) are potted together with solder and con- ected by a short lead to one of the ugs on the switch.

A point to remember with the oggle switches is that, when the oggle is laying towards one set of erminal lugs, it is performing the witching operation on those ter- ninal lugs. In the case of DPDT oggle used here, the two pairs of erminal lugs are being separately ridged when the toggle lays towards hem.

The two shielded leads which run o the terminals at the rear of the et are now laid in position and, if ıecessary, the braids can be spotted ogether at one or two points to keep hem tidy. In fact, they can often ɔe stapled here and there to prevent ıccidental rubbing on the motor rame or other such projections.

PREPARING LEADS

All that remains now is to prepare he inner wire of the two shielded eads for insertion into the terminals ɔn the set. Spot the braids together ınd connect to the "earth" terminal ɔf the three "pick-up" terminals.

Studying the operation of the DPDT ıwitch in, say, the "radio" position, he inner wires of the two shielded eads running to the set are shorted ogether, the pick-up leads are open- ɔircuited and the radio will tune in ıtations in the normal manner.

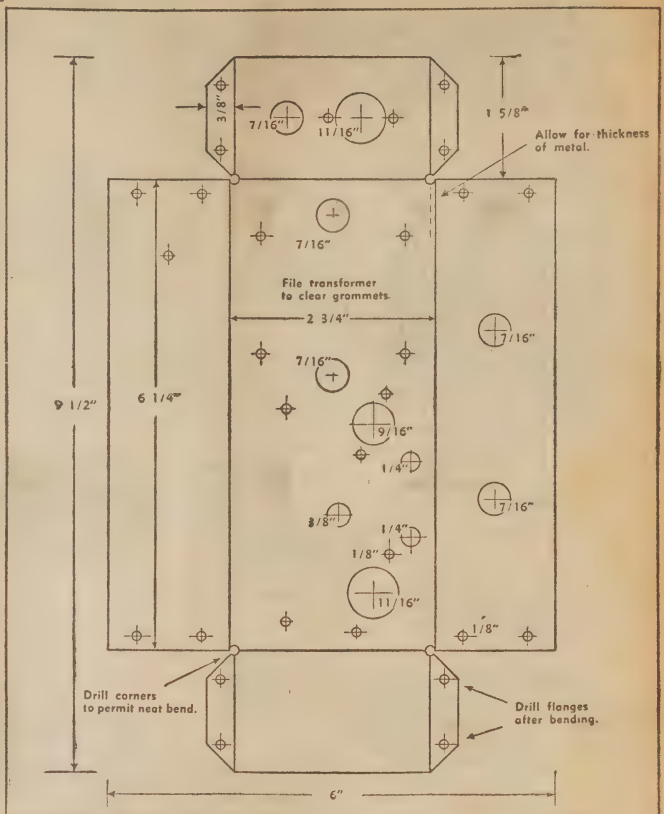
In the other position, which we will call "gramo," the connection be- ıween the inner wires of the two hielded leads is broken and the adio signals are shorted to earth ɪia the braid of the cables. The pick- ıp is brought into circuit, connecting ınto the audio section of the set via ɔne of the shielded leads. The vol- ıme control of the set will function ɔr "gramo" as well as for "radio."

Earthing of the radio signal lead nentioned above is a precaution to .essen any "breakthrough" of radio ɔrogramme when switched to 'gramo."

In more elaborate radiogram de- ıigns, we have frequently specified hat the pick-up switching be per- ɔrmed inside the receiver chassis, serving to break not only the con- nections to the detector but also re- moving the screen voltage from one ɔr more of the RF valves, thereby rendering the set completely dead to radio signals.

At the level which the volume control normally occupies, it is un- likely, however, that any signals will get through on the "gramo" position with this simpler circuit. If they do, it is generally sufficient merely to turn the dial away from a strong local station.

BABY RECORD PLAYER CHASSIS



Here is a diagram showing chassis dimensions for the one valve record player described on pages 52-59. It is scaled to exactly half original size. All unmarked holes are $\frac{1}{8}$" diameter.

Almost any kind of pick-up can be used with the set except the low output lightweight magnetic type.

Most record player or record changer units employ conventional magnetic units which are robust and reliable but harder on the records than other types. Their response is generally lacking in the bass register and, for those who like to experiment, we have included the details of a simple compensating network which can be connected between the pick-up and the switch. It involves only three or four components.

The crystal types will generally give a better overall balance without compensation. They come in styles ranging from the conventional replaceable needle variety to a lightweight wide-range type. This latter can be used quite successfully with the set.

CURING MODULATION HUM

WHEN hum in receivers and amplifiers is not produced by faulty filtering, stray a.c. fields, and other common faults, it may be caused by heater-to-cathode leakage in one or more of the tubes.

The easiest method of locating the bad tube is by substitution. However, this method is not too reliable unless two or more of each type tube are available.

Another method is to disconnect the tube heater from its a.c. supply and use a battery to heat it. The battery should deliver the required voltage and current. A rheostat and voltmeter can be used to adjust the voltage to the correct value. Try this on each tube until the hum disappears. This tube should then be replaced by one of the same type hand-picked for hum-free service.

In AC/DC sets, the heater string must be completed by a resistor equal to the "hot" resistance of the heater it replaces. The resistance is equal to the heater voltage divided by the heater current in amperes.

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- ★ Bakelite socket for 5BPI Tube.

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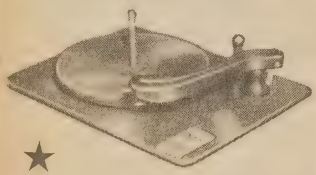
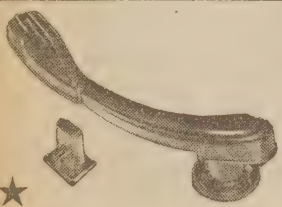


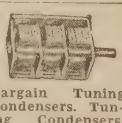
BRAND NEW ENGLISH PLESSY RECORD-CHANGERS. Play 8 records, 10" and 12" mixed, with high fidelity pickup. As illustrated. Reduced from £18/11/4 to only £6/19/6 complete.

Speaker Transformer and Speaker Winding Bargain. Speaker Transformers. Price, as illustrated, 3/11. Speaker Windings, 1/11 each.

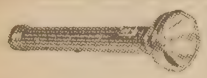
Bargain Home Broadcasting Microphones. Home Broadcaster Microphones will work with any ordinary radio. Adds fun to a party. Cut to only 7/11. Plus battery, 2/5. Connecting wire, 3d per yard.



PICKUP BARGAIN. Streamlined plastic lightweight. High fidelity crystal pick-ups, with only 1 to 11-8oz. needle pressure. As illustrated. Reduced from 49/6 to 29/11.



Bargain Tuning Condensers. Tuning Condensers, complete with trimmers. Two-gang, reduced to 8/11. Three-gang reduced to 12/11.



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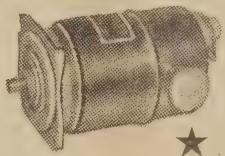
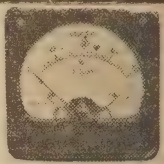
BARGAIN RADIO CHASSIS. 5-Valve steel drilled ducoed chassis. As illustrated, 1/- each.



DISPOSAL BARGAIN! 12-volt 500 watt generators. Completely reconditioned. Ideal for home-lighting plants. Originally cost £50. Price, as illustrated, 10 Gns.

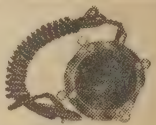
MOTOR BARGAIN. Brand New Electric Synchronous Motor. Plays 10 and 12-inch records. Constant speed. Price, as illustrated, 59/6.

MORSE KEYS. Morse Key Bargains. Brand new Army type Morse Keys. Small type, as illustrated, only 1/6. Large type, as illustrated, only 2/6.



METER BARGAIN!! English Moving Coil Meters. 2-inch scale, 200 ohms per volt. Two models available. 0-20 volt, 0-40 volt. Ideal for home-lighting plants. Originally cost 70/-. Cut to only 19/11.

BARGAIN FOUNDATION KIT. A few more available. Bakelite cabinet, chassis, front mounting plate and dial assembly. As illustrated. Only 39/11 complete.



MICROPHONES. Again available. English D104 High Fidelity Crystal Microphones. As illustrated, only £4/19/6.

TRANSFORMERS. Brand new 173 KC IF Transformers. "Kingsly." Reduced from 13/9 to 1/11 each.

METER BARGAIN. Pocket-type Dual Reading Moving Coil. English Electrix test meters. 0-20v., 0-200v. scales. 200 ohms per volt. Complete with leads, as illustrated. Worth £3. Cut to only 19/11.

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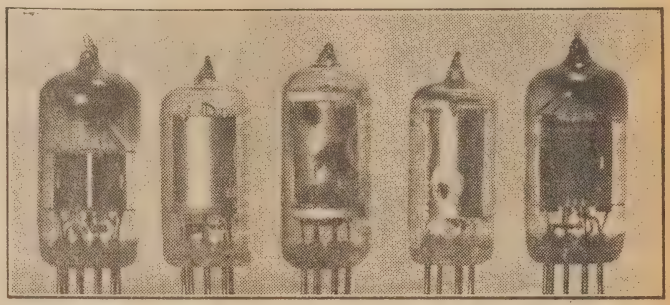
TRADE REVIEWS AND RELEASES

RADIOTRON RELEASES NEW MINIATURE VALVES

In line with the present trend towards miniature valves and components, the Amalgamated Wireless Valve Company have announced the local release of several types which have hitherto appeared only on overseas catalogues.



T is possible, in the space available, only to outline the general characteristics of the types concerned but more detailed information is available on application to the A.W. Valve Co. Pty. Ltd., 47 York Street, Sydney.

TYPE 1A3: A high frequency diode for battery operation with a 1.4v 0.15a indirectly-heated cathode. Fitted with a 7-pin button base, it has as a peak inverse voltage rating of 330, a peak current rating of 5A and a heater-cathode insulation rating of 140 volts. Natural resonance of the tube approximates 1000 Mc.

TYPE 6C4 (or D77) is a miniature high frequency triode with a 6.3v .15a heater. In audio service, its characteristics are similar to those of the well-known general purpose 6J5, but the button-base 6C4 has RF frequency ratings to 200 Mc. Price is 19/-.

TYPE 12AT7 is a twin triode with tapped heater allowing operation from either 6.3 or 12.6 volts. Fitted with a 9-pin novel base, it has characteristics generally similar to the earlier 6J6 and is suitable for audio or video service, or as the detector-oscillator in TV receivers up to 300 Mc. Price is 21/9.

TYPE 12AU7 is another twin triode with a tapped heater. Virtually two 6C4 triodes in the one envelope, it is a miniature 9-pin novel version of the popular 6SN7-GT. Price is 20/3.

TYPE 12AX7 is a twin high-mu triode, with a tapped heater and on a novel base. The characteristics are generally similar to the older octal based 6SL7 and the tube is intended for audio service where high gain per stage is required. Price is 21/7.

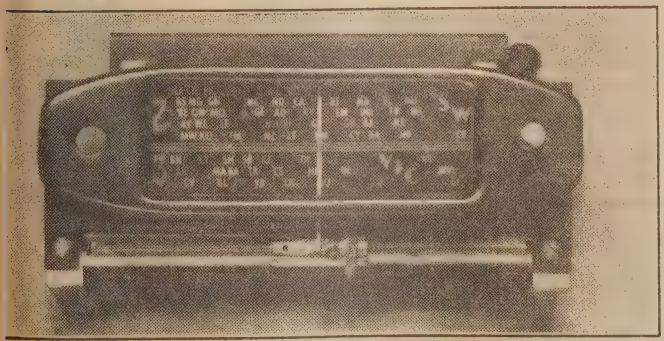
QS70/20, QS95/10, QS150/15: The three slightly smaller tubes illustrated in the centre of the group are miniature voltage regulators, the exact ratings being indicated by the type numbers. Thus type QS70/20 has a voltage rating of 70 and a maximum current rating of 20 milliamps. This particular type retails for 28/2, the other types being 24/11.

Supplies are expected shortly of the QS83/3, which is especially designed for applications requiring a closely regulated voltage source.

Other types being added to the range include the 6AM6 (or Z77) which is a popular priced high Gm RF pentode with a figure of merit approaching that of the 6AK5.

Also of special interest is the 6AL5 (or D77), which is a miniature high perveance diode.

AUTO DIAL WITH STATION NAMES



Latest release from the Efco Mfg. Co. Pty. Ltd. is the MSL/48 dial carrying call-signs in place of the simple frequency scale originally supplied. In this form, the dial is specially suitable for use in small mantel receivers. The escutcheon has a bronze finish and the scale illustrated is for an AWA gang and has calls for NSW and Victorian stations. Other glasses are available to order. The dial is handled by normal trade houses.

MARCONI SCHOOL OF WIRELESS

KEEPING in with the ever-changing step of radio theory and practice, the Marconi School of Wireless have completed an exhaustive revision of their whole syllabus.

One of the major activities of the school is the training of students for the various PMG Operators' Certificates, ranging from first to third class commercial operators, first to third class aircraft operators, and broadcast operators.

All these involve an excellent basic course in radio theory up to and including transmitters and station equipment. Aircraft and commercial operators carry on with courses on frequency modulation and radar, together with a study of morse telegraphy and telegraph regulations.

Students are enrolled for day or evening classes, which includes practical instruction on typical radio equipment. Correspondence students are also accepted.

In addition to the above, the school offers a mathematics refresher course and a service mechanics' course for those requiring this type of training.

The papers submitted for Radio and Hobbies review are well presented and apparently printed by a lithographic process. The type matter and figures are particularly clear. A review of the radar course, in particular, revealed full details of techniques and devices which were developed and used during the closing stages of the last war.

A department of AWA, the Marconi School is established at 47 York Street, Sydney, and 167 Queen Street, Melbourne. A brochure giving details of the courses, schedules and fees is available on application.

Waltham TRADING Co.

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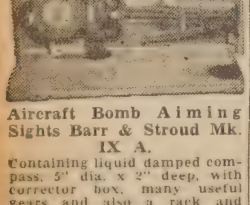

Aircraft Bomb Aiming Sights Barr & Stroud Mk. IX A.

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English "H" Type. Incorporating a Voice Powered Handset and Bell-generator. NO BATTERIES REQUIRED. Simple to install by connecting two wires to each Unit.

Two telephones and 100 yd. reel twin wire **£8/12/6**

Extra 100 yd. reels twin wire. Per reel 17/6

Addition telephone units. Each £3/17/6

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"It Whistles While It Works."

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Metal pipes and cables can be traced quite deep down in the ground. This saves the laborious, costly and time-wasting digging of "search holes," when the underground path of the pipes is uncertain, as it frequently is.

And throughout all, the metal detector "whistles while it works."

The units contain two interchangeable sweep coils, one large and one small, and pack complete with valves and headphones Packed in stout wooden transit case, 10" x 12" x 4' 6".

PRICE, each .. .. £8/10/- Total weight, 80lbs.

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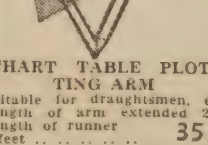
18" x 18", complete with Pantograph **17/6**



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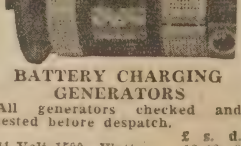
Suitable for draughtsmen, etc. Length of arm extended 24". Length of runner 3 feet **35/-**

Postage and Packing: Vic., 2/-; N.S.W., Tas., S.A., 3/6, Qld., N.T., W.A., 5/-.



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All generators checked and tested before despatch.

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24 Volt	1500 Watt ..	12	10	0
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12 Volt	750 Watt ..	12	10	0

WESTERN ELECTRIC U.H.F. FOUR VALVE MIDGET RECEIVER

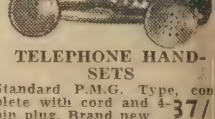
Frequency 238 to 258 Meg cycles Valves 3—945, 1—[illegible] Super Regenerative Receiv Brand New **£2/19/**

Postage and Packing: Vic., 2/ N.S.W., S.A., Tas., 3/6; Q W.A., N.T., 5/-.

SELSYN MOTORS

50 volt 50 cycle, ideal for u with Rotating beam aerials **30/**

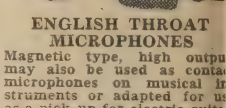
Postage and Packing: Vic., 2/ N.S.W., Tas., S.A., 3/6; Qld N.T., W.A., 5/-.



TELEPHONE HAND-SETS

Standard P.M.G. Type, com plete with cord and 4-3 pin plug. Brand new .. **37/**

Postage and Packing, 2/6, States.



ENGLISH THROAT MICROPHONES

Magnetic type, high outpu may also be used as conta microphones on musical in struments or adapted for us as a pick-up for electric guita Comprises two microphon units which may be used sepa ately. **12/**

Brand New .. ..

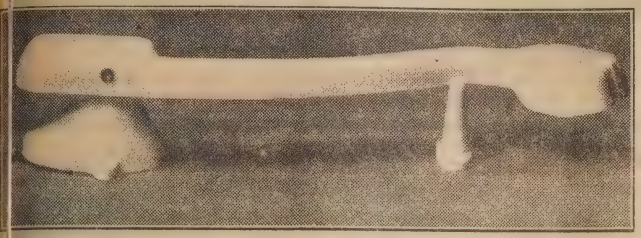
Postage and Packing: Vic., 9 N.S.W., S.A., Tas., 1/-; Qld W.A., N.T., 1/3.

R.A.A.F. ASTRONOMICAL IN STRUMENT can be utilise to measure horizontal and ve tical angles such as those en countered in road making an irrigation work. It is fitte with scales calibrated in de grees, two levels and adjus able turntable mountings. **£2/15/**

Postage and Packing: Vic., 2/ Tas., S.A., N.S.W., 3/6; Qld N.T., W.A., 5/-.

GOLDRING AUTO-STOP PICK-UP

tended especially for replacement purposes, Goldring have released what they term the "Super Auto Pickup," number 137-A.



IE particular feature of this pickup is a very light-action tch built into the base which ches off the motor when the up runs into the finishing ves at the end of a disc. This ure allows the normal heavy -stop mechanism to be dis- ied on old motors and therefore ids one of the chief difficulties ciated with the replacement cedure.

he pickup itself makes no claim extreme fidelity or extreme light ght, being intended to replace older and heavier magnetics, re- ing record wear but preserving same general output character- cs. It employs a conventional needle chuck and screw and can be used with steel, thorn or sapphire needles, as required.

Manufacturers' figures give the nominal output as 0.7 volt at 1000 c/s with an impedance of 15,000 ohms. The needle pressure is 40 grams and recommended load 0.1 meg. The published curve indicated an expected resonance at about 3500 c/s, the response crossing zero db. at 4000 c/s and tapering away to 10db. down at about 6000 c/s.

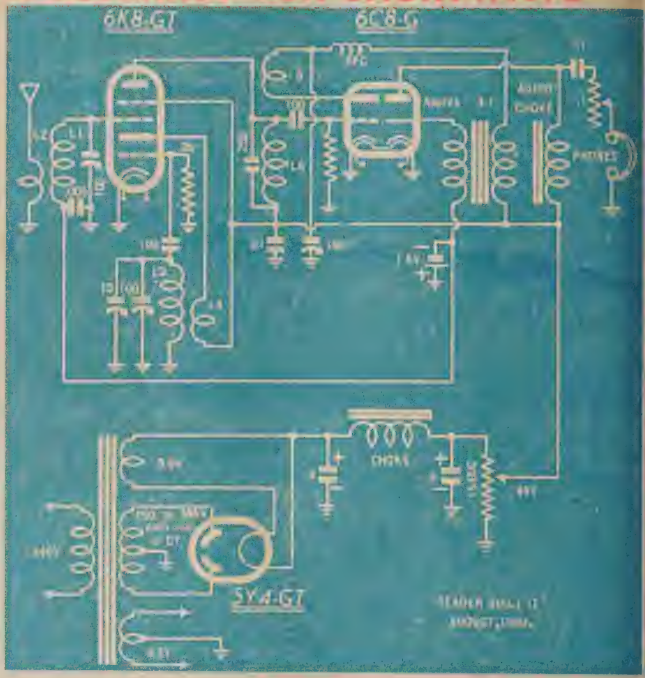
The arm is attractively moulded in ivory plastic and can be had without the auto-stop (Number 137). Supplies are expected shortly and release will be through normal trade houses.

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A REGENERATIVE SUPERHET FOR SHORTWAVE

Some of the younger readers gaze in envy at the descriptions of complicated multivalve communications receivers with impressive selectivity and sensitivity figures. However, this little set, if carefully built and adjusted, will bring in shortwave stations from all over the world and it even has enough selectivity to give a good account of itself in the crowded amateur bands.



Mr. Bryska's circuit. The 100 pf. variable condensers L1 and L3 are used to tune to the required band and the 15 pf. condenser for fine tuning within the band.

THE design was sent in by Mr. L. Bryska, of 17 Karrela Road, Cremorne, NSW. He says: "I hope readers of Radio and Hobbies will welcome this little short-wave set, which gives results equal to much bigger communication receivers." A similar design has appeared in an overseas handbook, but it is likely that many of R. and H. readers have not seen it.

The circuit consists of a frequency converter valve feeding into a regenerative detector on a frequency of approximately 1600 kcs., followed by a transformer-coupled audio stage. The power supply is required to deliver between 45 and 90 volts. It would appear that he has used parts that he happened to have on hand, but individual readers could easily modify this section of the circuit to suit their own requirements. The current drain should be quite low, making batteries a proposition worth considering.

The regenerative detector working at a low fixed frequency is able to give a much better account of itself in regard to both selectivity and gain than if it were working at the signal frequency. The fixed frequency also obviates the necessity for critical adjustment of the regeneration control each time the set is re-tuned.

The frequency converter circuit is quite straightforward, and is similar to that included in every standard superhet. Points to watch are short leads in the input circuit and mechanical rigidity in the oscillator assembly.

Transformer coupling of the audio amplifier stage helps to provide the extra gain required for building up the weaker and more distant stations.

There are a number of alternative valve types you could use if the happen to be on hand. The 6K8 probably the best choice for the converter, since the oscillator section works well on the low voltage, but any one of the standard triode-hexode converters should work quite well. Types 6SN7-GT and 6SL7-G would work in place of the 6C8-G specified. The 5Y4-GT specified by the circuit is a direct electrical equivalent of the more usual 5Y3-GT.

In practice, it may be necessary to experiment with the feedback winding of the IF coil to obtain smooth regeneration. Either add or subtract turns as required. The exact frequency of the IF channel is not particularly important. If the

(Continued on Page 77)

COIL GUIDE

I.F. COIL

L6 55T 30 gauge wire closewound on a ¾" diam. former.

L5 18T 30 gauge closewound near L6.

OSC. COIL:

L3 12T 22 gauge enam. wire wound to a length of 1½" on a 1½" diam. former.

L4 7T 24 gauge enam. wire closewound ⅛" from bottom of L3.

AER. COILS:

Range A, 5.4 to 10.0 mcs.

L1 18T 22 gauge enam. wire wound to a length of 1½" on a 1½" diam. former.

L2 7T 24 gauge enam. wire closewound ⅛" from bottom of L3.

Range B, 9.5 to 14.5 mcs.

L1 10T 22 gauge enam. wire wound to a length of 1½" on a 1½" diam. former.

L2 7T 24 gauge enam. wire closewound ⅛" from bottom of L3.

All coils wound in the same direction. Top of oscillator feedback winding (nearest grid winding) connects to B plus.

The same oscillator coil is used for both bands. It is operated above the signal frequency for range A and below for range B. Coils for other ranges may easily be wound if desired.

EXCEL KITSETS

R & H KIT No. 1
SIMPLIFIED SUPER-HET

The Kit complete to the last nut and bolt. Including Valves, 12" Speaker.

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DUAL WAVE MODIFICATION
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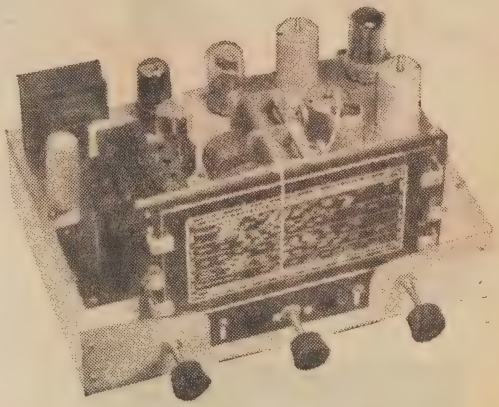
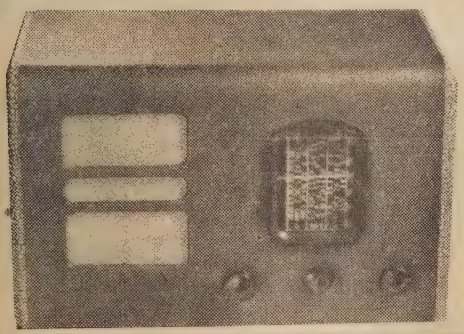
WIRED AND TESTED
B/C £16-7-6
D/W £17-2-6



MANTEL VERSION

INCLUDING CABINET AND 6" SPEAKER



B/C £15-2-6

D/W £15-17-6

Wired and Tested. B/C £17/12/6
Wired and Tested. D/W £18/7/6

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136 VICTORIA ROAD, MARRICKVILLE, N.S.W.

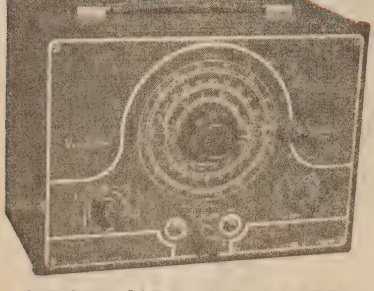
TEST EQUIPMENT FOR SPEED AND ACCURACY

University

MODEL MVA/2 MULTIMETER

Undoubtedly the most popular Multimeter in Australia. A reliable first-class Instrument designed for either use on the bench or as a portable Instrument in the field. It has a wide range of A.C. and D.C. volts up to 1000 volts, also a wide range of output from —10 db to plus 45 db. D.C. current can be read from 1 Milliampere in several ranges up to 10 Amperes D.C. It its self-contained in its resistance readings which are four separate ranges up to a total of 1 megohm. Values as low as .25 of an ohm can be measured on the low Scale.

Firmly and sturdily built yet pleasing in appearance, the MVA/2 fills a long-felt want. A.C. and D.C. current ranges can be extended and a leatherette covered Carrying Case is available separately if so desired.



MODEL XOA OSCILLATOR

This fine Oscillator is available either as an A.C. operated Instrument or as a Battery operated Instrument. It has a comprehensive frequency coverage from 160 Kilocycles to 32 Megocycles in five bands. It can be used unmodulated or modulated. The modulation is 30% at 400 cycles. The Dial and Output Control are calibrated and the Instrument is entirely self-contained.

WRITE FOR FURTHER DETAILS

MRCT CURRENT TRANSFORMER

This handy little Instrument is designed to increase the alternating current range of any suitable Multimeters such as Model MVA/2 above. It allows you to measure A.C readings as follows:—

2½, 5, 10, 25, 50, 100, 250 and 500 mA.

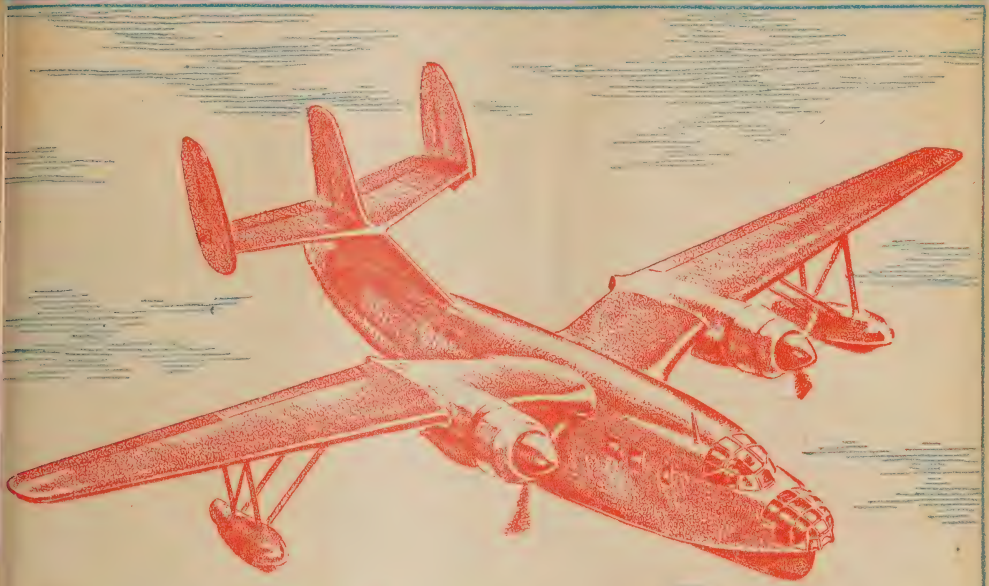
1, 2½, 5 and 10 Amperes. A.C.

University

RADIO KIT SETS • RADIO & ELECTRICAL TEST EQUIPMENT

MADE BY UNIVERSITY GRAHAM INSTRUMENT CO., 5 North York Street, Sydney. Phone BU3169—2 lines.

A SEA RESCUE PLANE FROM FRANCE



NORD 1400 "NOROIT"

A twin-engined reconnaissance and sea-rescue amphibian flying-boat is now in production for the French Navy. It is the Nord 1400 "Noroit". First flown in 1948, the Noroit is a product of the Societe Nationale de Constructions Aeronautiques du Nord (S.N.C.A.N.).

THIS organisation was formed 13 years ago under the laws for ıe nationalising of the French air-raft industry. In it were combined ıe former Potez, CAMS, and Les ſureaux companies, while it also ɔok over some plants from the ımiot and Bregeut concerns.

Since its postwar rebuilding and e-equipment, SNCAN has under-ɜken an extensive programme of ircraft design and construction.

The Nord 1400 is a cantilever gull-ving monoplane. The wings, which ave an aspect ratio of 10, feature ll-metal two-span structure with tressed skin covering. Fixed all-ıetal wing-tip stabilising floats are ıounted on N-struts.

The hull is of conventional two-tep type, all metal.

The tail unit, with twin fins and udders, shows marked dihedral in ıe tailplane. Fixed surfaces are of ll-metal structure, while elevators nd rudders are fabric-covered on ıetal frames.

Motors are 14-cylinder two-row adial air-cooled Gnome-Rhone 14R25's. The airscrews are of the full-feathering and reversible type.

Accommodation is provided for a crew of seven.

Armament is listed as two fixed forward-firing 20mm cannon in the wings, two 20mm cannon in the turret over the wings, and two 20mm cannon in the tail turret.

Weights and performance of the amphibian and flying-boat versions are different.

STATISTICS

In the case of the flying-boat, empty weight is 22,462lb and disposable load 13,376lb, making a total loaded weight of 35,838lb. Maximum speed is 216 miles an hour, cruising speed just under 140 miles an hour, and alighting speed 75 miles an hour. Range in still air at 1650ft is 1864 miles.

In the case of the amphibian, empty weight is 24,640lb and disposable load 12,650lb, giving a total loaded weight of 37,290lb. Top speed is 214 miles an hour, cruising speed 129 miles an hour, and landing speed 76 miles an hour. Range is 1552 miles.

Service ceiling is 25,590ft in the flying-boat and 25,100ft in the amphibian.

Main dimensions of the Noroit are: Wingspan 103ft 8in, length 70ft 11in, and height over tail 18ft 6in.

A READER BUILT IT

(Continued from Page 74)

detector fails to oscillate, try reversing the connections to the feedback winding.

Mr. Bryska built the set on a chassis 12in x 8in x 2½in, with a panel 8in x 12in, but readers should have no difficulty in solving the mechanical problems. Some experiment with the relative positions of the audio and power transformers may be necessary to prevent hum if the two are mounted on the same chassis.

(Readers will probably also be interested in the simple superhet. design included in the Australian Shortwave Handbook, which has just been published.—Ed.)

HOW TO LAUNCH YOUR SPEED MODEL

Following on the design and construction data contained in last month's Radio and Hobbies, is this article in which I propose to explain the technique I use to secure consistently reliable performance from my racing model aeroplanes.

by Jack Finneran

YOU may have wondered how this model is launched into flight as there was no evidence of a wheeled undercarriage. In this month's plan you will find the answer.

This plan reveals the sizes and set up of what we call a "dolly." It is in effect a wheeled cradle, which carries the model, acting as the undercarriage until such time as it reaches a speed which will lift it from the cradle and keep it airborne.

I use a "dolly" of three-wheel configuration and generous size, so that it will be completely stable while rolling over the take-off area. This "dolly" design, having a vertical spike which fits into a hole on the under side of the model, has proven to be perhaps the most successful of all the dolly styles in vogue at some time or other.

GENEROUS SIZE

Its generous size in relation to the model makes for the ability to roll swiftly over moderately rough ground without spilling the model. Such stability is particularly useful if one launches the model with the motor running badly, as it can be kept on the ground for lap after lap without fear of it tumbling from the dolly with its consequent damage to propeller and plane.

Its construction can be 3/32 or 1/8 inch steel wire. All joints should be bound with fine tinned wire and then soldered. I use wooden wheels for want of better, although most any of the large rubber variety will do very nicely.

Excessive weight is to be deprecated as this will slow the acceleration of the model and increase the take off run.

TRACKING

Care should be taken in tracking the dolly to see that it rolls perfectly straight ahead, or if anything, slightly with the circle when pushed along the ground. Check this with the model mounted after each flight, as damage to adjustment of the dolly can easily occur, particularly as the dolly is often carried into the air and then dropped. On no account should the dolly roll to the outside of the circle, as this can be the reason for throwing a model from its dolly prematurely.

Remember your dolly is one of your most important pieces of equipment.

Each flight must start from it, and you must get airborne to win a speed competition.

Having built your plane, installed your motor, and constructed your dolly, you are partly on the way to become a successful "spindizzy," but there is yet a lot to be done. Unless you do the following things in an orderly manner you will not meet with overmuch success.

I do not mean to imply that the following is the only road to success. But the following is a good basis for a beginner, and in fact, is the manner in which I approach speed flying.

The following equipment is necessary:—

(1) A comfortable control handle with spaced holes so that control response can easily be altered. This handle should be made so that the top is easily identified, as this will eliminate the possibility of picking up the handle in such a manner as to have the top and bottom lines reversed. Reversed lines of course mean certain destruction to a speed model.

(2) A set of steel lines of .008 inch diameter are suitable for this model, and the length needed is such that the distance from the centre of the model to the front of the hand shall be 60 feet. Be sure to use lines which are without kinks, as these would be susceptible to breakage under flight strain. Small loops must be made at each end, bound and soldered.

(3) A good reel should be made or obtained on which the lines are rolled when not in use. This will speed up the laying out, or rolling up of lines when you are flying, and will reduce the risk of kinks.

(4) A fuel filler bulb is next. I use a small rubber bulb which is obtainable from the chemist. Fit it with a length of transparent plastic tubing. This is a better method than the fuel bottle filler which is in common use, as it obviates the necessity of placing one's lips on tubing tainted with nasty fuel concoctions.

(5) A fuel bottle of sufficient capacity for a full day's flying and preferably one that is not easi knocked over.

(6) Two 1½ volt dry cells wir in parallel and a suitable lead co plete with alligator clips for attac ment between batteries and engir You may use a 2 volt accumulator you wish, or else a motor cyc battery from which you can tap 2 volt supply.

(7) A tool box containing a mi cellaneous collection of the nece sary spanners, pliers, screw drive nuts, bolts, spare glow plugs, fu line tubing, needle valves and su other bits and pieces as may l useful in an emergency.

(8) A liberal number of propelle is a useful adjunct, as the mortali rate is high.

FUEL MIXTURE

Having gathered all these nece sary pieces of equipment togeth you are nearly ready for a flyir session. (You see flying really play the least part in one's spe activities).

Firstly if you are to succeed yo must eliminate as many of the var able elements as possible. You mu do this methodically, otherwise yo won't know whether you are improv ing or not.

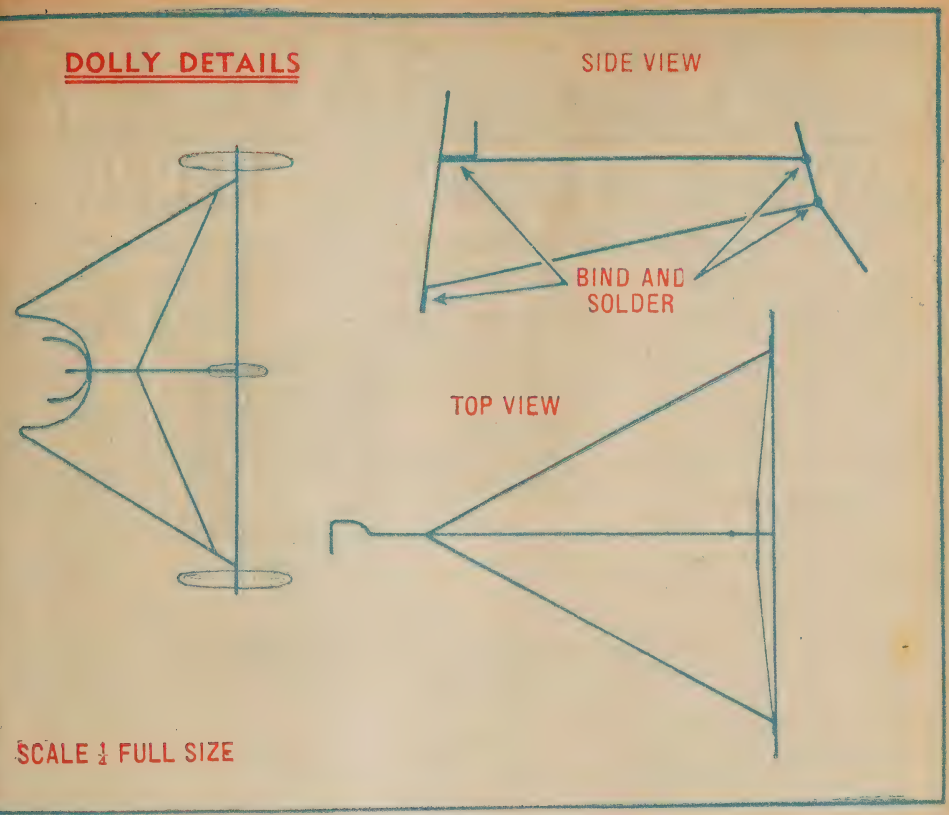
I get at it something like this. take the fuel recommended by th motor manufacturers and a propell which I know from experience ar from reading magazines wi be somewhere near what I requi and I work these against a re counter.

I use a basic fuel mixture of thre parts Methanol to one part Castrol "R" oil and add 1 per ce Amyl Acetate. I then run the mot in the plane, but with the top o for cooling purposes, and check th revs. I vary the Amyl Acetate co tent until I am getting the be motor performance. That becom my fuel for that particular motor. don't change this fuel for conte work, although I may experime with different mixtures when importance attaches itself to th results.

PROPELLERS

This eliminates one importa variable and the other particular important one namely the propell is attended to in flight tests.

To arrive at the best propell design, I fly with a certain propell and, after each flight, I slightly d crease blade area until peak speed reached. When further reduction area shows reduced speeds, I sett for the propeller design, but ke the area at that which gave the to



This diagram shows the construction of a speed model dolly.

Tit becomes the propeller for that ·or, plane, and fuel combination. 3 sticking to this procedure, you ıl get very consistent results and sistency alway pays dividends in ıpetition.

low to get to the business of ng one of these speed ships. Don't it yourself unless you have had easonable amount of experience ng other and slower types first. ırn to fly first on slow jobs—then n experience on something reason- y fast and then you may con- ntly tackle the high speed stuff. hey are not difficult to fly when rating properly. It is merely that y are very fast and, because of is, they are likely to get half a ahead of your thinking if you ı't watch out.

lowever, here's how.

IECK CONTROLS

uel the ship up and place it on dolly pointing down wind. Con- ıt the lines between plane and ıtrol handle and give it the usual test — that is — pull up twenty ıes the model's weight on a tension le so as to be sure that plane, es and controls will easily stand flight stresses of high speed flight. heck your controls to see that the vator is working properly without any sign of stickiness. Get ready to fly.

Start the motor and tune it to a fine scream. Disconnect the battery leads and retune that motor to maximum revs. Be slow and deliberate in these matters, and when the motor is at its peak, enrich mixture by ¼ turn on needle.

FIRST FLIGHT

Make your way to the control handle and pick it up right. Give the release signal to your helper.

Hold very slight up elevator as the model gets under way, and commences to accelerate. Keep slight up elevator and, when she is ready, she will rise (Don't lift her out of the dolly with excessive up) swiftly though flatly from the dolly.

Get her into level flight altitude at about 10 feet. Do this slowly, not violently, as fast reactions on your part will only lead to faster ones on the plane's part, and trouble for you will ensue.

Keep her low—ten feet or under—as trouble usually occurs due to excessive climb. If any oscillations are evident in flight, smooth them out slowly, and deliberately.

You will in all probability find that the ship tends to seek its own level, and will fly virtually on its own as though on a suspended wire. At these high speeds, the possibility of dizziness is very real, but if you concentrate your attentions on the plane, and the plane alone, without any attempt to watch the background, you will have done much to conquer dizziness.

The most difficult part is over—that is, the take off. If you let the ship fly itself in when the motor cuts, your landings will present no problems. Once the motor cuts, the plane still carries on its merry way and you should give very slight "down" so as to maintain speed as she gradually loses height.

When about two feet from the ground give slight back stick and watch the reaction. She should just flatten out. Don't let the nose come up. Try to keep her level about eighteen inches from the ground, and she will ease herself down and slide in on her belly.

You will now probably fall over or reel drunkenly around the field for a few seconds until your gyroscopic nerve unwinds itself.

Don't let this worry you as most chaps have this kind of reaction after a high speed flight.

Well, there you are chaps. There is more work than flying, but it is a very fascinating branch of the model hobby, and I feel sure you will agree should you try it.

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THE LAST OF THESE RECEIVERS THAT COST £286/-/-

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COMPLETE WITH 12 VALVES and CONVERSION CIRCUIT

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THE CONVERTED RECEIVER

with 55 to 1 ratio dial. 8" speaker in bakelite cabinet.

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Chassis fitted for S/W Converter.

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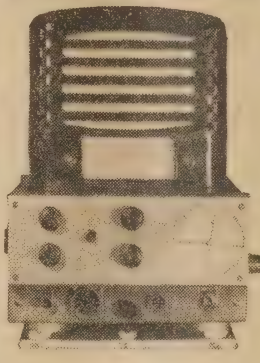
THE MOST SENSITIVE SET AVAILABLE IRRESPECTIVE OF PRICE.



CONTROLS: Volume, Sensitivity B.F.O. Tone & Tuning Wave Change Switch

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COMPASS LOOP AERIALS
An excellent Unit for Beam. Rotator fitted with Silver Slip Rings and Collectors. 20 to 1 gearing. Ball Race Bearings
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8-Pin Polarised. Large .. **5/6**
10-Pin Small Complete Units.
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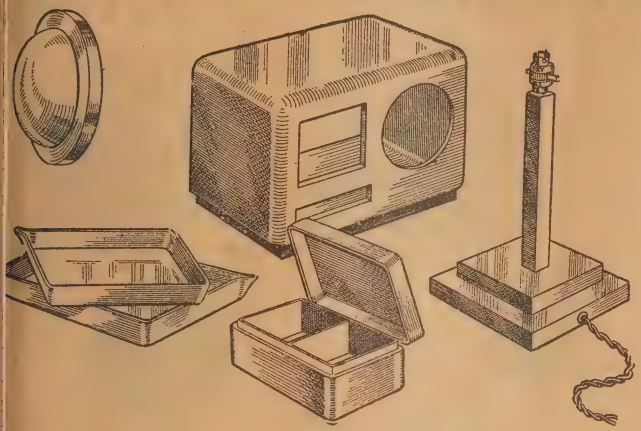
MAKING THINGS FROM PERSPEX



i. 4.—Various types of articles that can be made from Perspex. The table lamp and x are built up from flat sheets. The dishes can be built up or moulded. The wall mp is blown without a mould. The top of the radio cabinet is cut from a part that was blown in a mould. The base is built up from flat sheets.

Perspex is a material that is in good supply and which is particularly suitable for use by amateurs. It is very easy to work, and is one of the few materials that can be formed into complicated shapes without the use of elaborate equipment. Perspex can be obtained in the form of either sheets or block, both of which are available in a wide range of colors or as tinted, translucent or clear material.

ERSPEX is already used by many people, but it is doubtful if they alise its full scope. It is hoped at this article will interest them in e more advanced uses of the aterial, as well as introduce new- mers to the possibilities of perspex.

The material is very easy to work hand. Most tools that are used r wood or metal can be used on rspex. As the material, when it is id, tends to be brittle, care should taken to see that it is always well pported to avoid the danger of it acking.

OTECTIVE COVERING

Perspex sheet is often supplied th a protective covering of paper both its faces. This covering is ld with a gelatine adhesive, and much work as possible should be ne before it is removed. The cover- g greatly assists marking out, hich can be done with a sharp ncil, and it also protects the aterial from being scratched or lashed with solvents.

When required, the covering can removed by soaking the sheet in arm water and then peeling off the per. The sheet should be washed wn with warm water to remove l traces of gelatine and then dried ith a soft cloth. On no account ould the sheet be subjected to at before all traces of the gelatine have been removed, as it badly marks the material when warmed.

CUTTING AND DRILLING

Perspex can be cut with a hack-saw. A 10in blade with 14 or 18 teeth per inch has been found to give the best results. If the blade is lubricated with water it considerably eases the cutting and prevents the blade from jamming due to the material softening.

Thin sheets of perspex, up to an eighth of an inch thick, can be cut by scribing a line about a quarter of the thickness of the sheet in depth and breaking along the line. The break should be started at one end and gradually worked along the line.

Holes can be drilled with ordinary metal twist drills. Care should be taken when breaking through on the under-side of the sheet as the material is liable to crack round the edge of the hole.

A drill with the end less pointed than is needed for metal will be found to have less tendency to crack the sheets, and will give the best results. Large holes can be cut with a tank or fly cutter.

CEMENTS

There are several cements on the market for jointing perspex. Perspex Cement No. 6 and Diakon Cement No. 2 are the most common. Chloroform and ethylene dichloride can also be used as cements, and give good results. Instructions for use are usually supplied with the commercial cements, but the following hints may be useful for using chloroform and ethylene dichloride.

Absolute cleanliness is essential in making joints. Any dirt that gets into the joint will be cemented in and give the joint a bad appearance. The cement should be applied locally to the surfaces to be jointed, and should not be allowed to contact the surrounding material as it leaves a rough mark that spoils the surface.

Speed is essential in making joints as the cement dries very quickly. All the surfaces should be prepared, and all the material be ready to hand before the cement is applied. If the cement becomes too dry before the surfaces are put together a satisfactory result will not be obtained. Joints should be allowed to harden for at least two hours before they are handled.

TYPES OF JOINTS

Several of the types of joints that can be used are shown in Fig. 1. Straight butt joints are made by soaking the edges of the material in either chloroform or ethylene dichloride for about ten minutes and then pressing the edges together. Butt joints should only be used where the joint is lightly loaded. Where greater strength is required a strap joint should be made. The strap should be of the same material as the sheets and its width should be

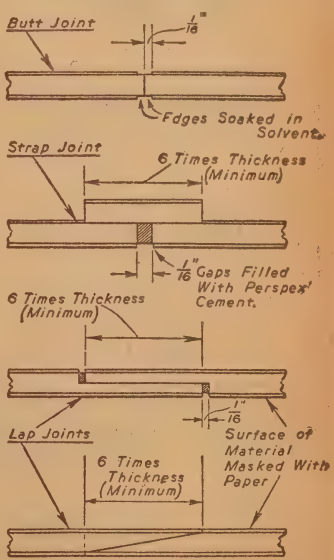


Fig. 1.—Various types of joint that can be used for joining Perspex sheet.

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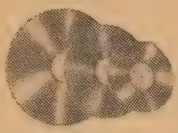

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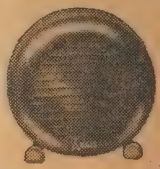

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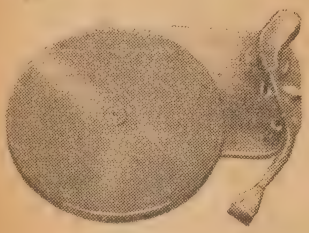

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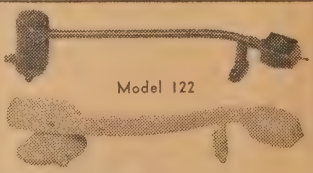

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less than six times the thickness.

he cement should be applied to surfaces to be jointed and the t held under slight pressure for hours. When the joint has dened the 1/16in gap is filled either the perspex cement or a tion of perspex dissolved in roform. The lap joints shown in 1, although harder to make, give d results.

hen making joints the area und the joints should be masked h gummed paper to prevent the ent from adhering to the sur- nding material. When the joint is shed the paper can be washed

MOVING SURFACE MARKS

here perspex has been marked to working or handling, the ks can be polished out. If the ks are deep they can be smoothed r with a fine file or sandpaper. t is an edge that has to be clean- up a wood plane will be found give good results. Perspex Polish mber 1, which can be obtained n dealers, is next rubbed over the face. The rubbing should be done h a circular motion and only light ssure used. The Perspex Number olish is followed with Perspex 2, which is the finishing polish. he proper polishes are not avail- e, ordinary metal polish will be nd to make a good substitute.

THODS OF SHAPING

y far the most interesting and ful property of perspex is the ease h which it can be formed into plicated shapes. The shaping is e when the perspex is softened er heat.

Several methods of shaping are sible. Simple shapes can be ob- ned by heating the material and ing it over formers while it cools. re complicated shapes are obtain- by blowing the material into lds with compressed air. The paratus required for doing this is cribed below.

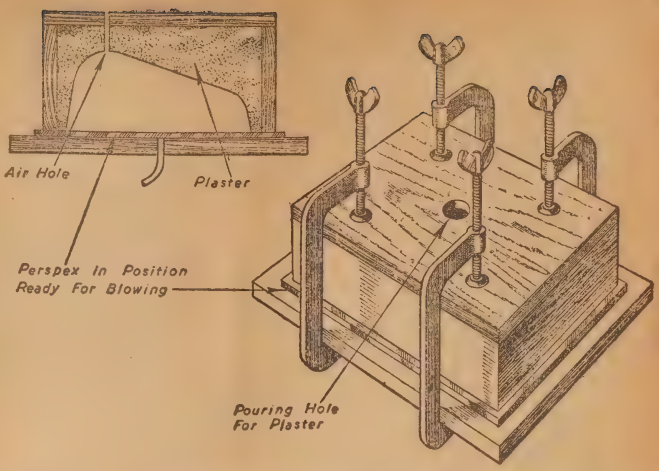

Fig. 3.—Showing mould box clamped in position on blowing board, and a section through mould box.

Perspex softens at a temperature of between 110 degrees C and 130 degrees C. The heating can be done in an ordinary household oven. Before heating, the paper covering must be removed from the sheets and all traces of the gelatine adhesive washed off. The sheets should be laid on soft cloth in the oven so that there is no danger of their being scratched.

Care should be taken not to over heat as this causes small blisters to appear on the surface of the material. With a little practice the correct temperature can be judged by the feel of the sheets. When the material has reached the required temperature for shaping it can be picked up by the edges and will feel quite limp. The feel of the material should be checked at regular intervals during the heating process to see if it is ready for shaping.

A very useful property of perspex is the ease with which it can be made to recover its original flat form after being shaped. If the material has been shaped and it is found that the result is not satisfactory it need only be re-softened in the oven and it will fall back to a flat sheet. This returning to the original flat state is complete, and a sheet that has been treated in this manner cannot be distinguished from a new piece of material.

SIMPLE FORMERS

Perspex is formed into shapes involving single curvature by bending over simple formers. These formers may be made from wood, plaster or clay. They should have a smooth finish and better results will be obtained if they are covered with thin rubber or soft cloth. The perspex is first heated in the oven and then laid over the former until it cools. If the bends on the former are such that the material does not follow the profile, it may be pressed into position with a soft pad. This pressure must be maintained until the material has hardened.

COMPRESSED AIR APPARATUS

Double curvature shapes are best formed by blowing the material into moulds with compressed air. If a supply of compressed air is not available the apparatus shown in Fig. 2 will be found to give good results. This consists of a pressure tank and a pipeline connecting it to the blowing board. A petrol tank from an old car will be found to make quite a good pressure vessel. A Schrader valve should be inserted in the tank. This is done by drilling a hole in the diameter of the valve and inserting the valve from the inside through the inspection panel in the tank. Rubber washers should be placed around the valve at each side of the tank to prevent air escaping. The petrol outlet union in the tank is a suitable place to connect the air pipe. The filler and air hole in the tank must, of course, be sealed. This can best be done by brazing a patch

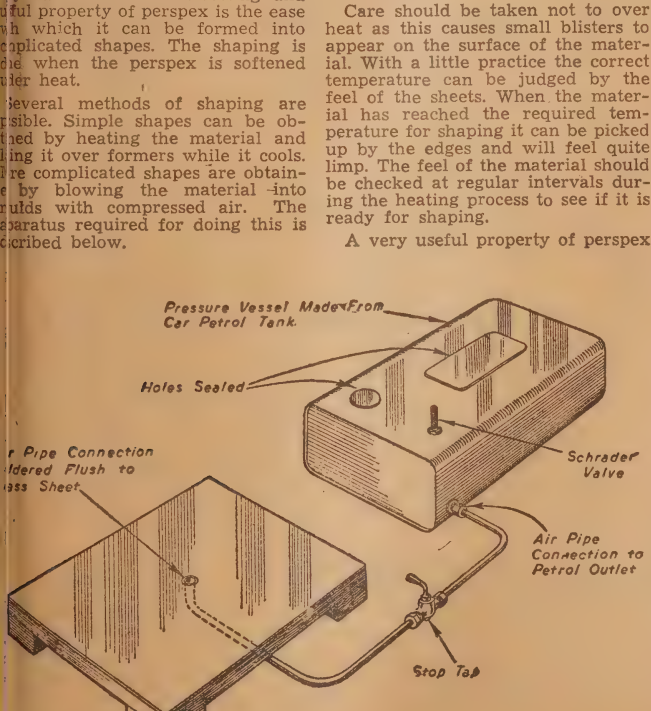

Fig. 2.—Apparatus required for blowing Perspex sheet.

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	A.C.	Vib.			Retail
PF 122	240	6	220	40	33/6
PF 125	240	6	250	60	43/-
PF 119	240	6	325	125	62/-
PF 182	240	12	200	40	33/6
PF 126	240	12	250	60	47/6
PF 146	200,30,40	12	325	150	67/-

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	Induct.	D.C. Res.	M.A.		Retail
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CF 102	15	300	60		12/-
CF 103	30	420	60		26/-
CF 104	30	380	75		31/-
CF 105	15	250	80		24/-
CF 106	12	200	100		24/8
CF 107	30	360	100		34/8
CF 108	12	135	150		35/-
CF 109	20	225	150		37/8
CF 110	12	100	200		43/8
CF 111	16	165	200		45/10
CF 112	10	70	250		46/2

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CF 113	.5	70	250		
	20		50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
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OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.8, 2	20	36/9
OP63	10000 PP	15, 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

OUTPUT TRANSFORMER TO VOICE COIL

Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	130/-
OP25/16	10000 PP	16, 4	15	130/-
OP25/15	10000 PP	15, 3.75	15	130/-
OP25/12	10000 PP	12, 3	15	130/-
OP25/10	10000 PP	10, 2.5	15	130/-
OP25/8.4	10000 PP	8.4, 2.1	15	130/-
OP66	5000 PP	8.4, 3.7	15	130/-
OP67	5000 PP	15, 6.5	15	130/-

OUTPUT TRANSFORMER TO LINE—

Full Freq. Range.

OP22	3250 SE	500, 125, 8.3	10	65/1
OP19b	5000 PP	500, 250, 125	15	102/10
OP21	8000 PP	500, 250, 125	15	82/10
OP62	10000 PP	500, 125	15	100/-

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OP25/500	10000 PP	500, 125	15	130/-
OP25/250	10000 PP	250, 62.5	15	130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	MA	Buffer Full Sec.		Retail
VT 100	32	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	"	19/6
VT 102	6	150	25	.005	"	23/10
VT 103	6	200	50	.005	"	25/-
VT 104	6	250	60	.005	"	37/-
VT 105	12	250	60	.005	Sync. Low Rad.	37/-
VT 106	6	300	75	.008	"	52/-
VT 107	6	250	60	.005	Sync.	30/6
VT 108	12	90	15	.008	"	21/8
VT 109	24	90	15	.008	"	23/8
VT 110	12	150	25	.005	"	23/10
VT 111	24	150	25	.005	"	26/6
VT 112	12	200	50	.005	"	25/-
VT 113	24	200	50	.005	"	26/6
VT 114	12	300	75	.008	"	54/2
VT 115	24	300	75	.008	"	55/6
VT 116	24	250	60	.005	"	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	"	25/4
VT 122	6	400	100	.005	"	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	"	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	32/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Ret
PF 185	240	150	50	6.3V @ 2A	24
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	30
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3 @ 3A, 5V @ 3A	144
PF 201	240	225	50	6.3 @ 2A	29/

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	
MT111	500	12.5, 8, 2.3	10	36/
MT100	600	4, 3	15	36/
MT101	500	15	15	36/
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	66/
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000 5000	25	85/-
MT119	8000, 6600, 3800 PP	10000, 7500, 6500 5500, 4500, 3500	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Ret
OP1	5000, 2500 SE	12.5, 8, 2.3	10	39/
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	43/
OP39	5000, 2500 SE	15	10	39/
OP33	5000, 2500 SE	5, 2.7	10	39/
OP41	5500 SE	3.7	10	46/
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	36/
OP2	5000 PP	12.5, 8, 2.3	15	65/
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/
OP3	6600 PP	12.5, 8, 2.3	15	65/
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/
OP4	10000 PP	12.5, 8, 2.3	15	65/
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	76/
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/

OUTPUT TRANSFORMER TO LINE — P.A. Rang

	Pri. Imped.	Sec. Imped.	Watts	Ret
OP1A	5000, 2500 SE	500	10	39/1
OP44	5000, 2500 PP	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	81/4
OP6	3000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP	500, 250, 125	25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 2	60	133/8
OP37	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500, 250, 125	150	276/-

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to the tank, an operation that n be carried out at any garage. he tank is charged with a car pump; pressure of thirty pounds per uare inch can easily be obtained this method.

As stated above, a pipe-line is led m the pressure tank to the blow- g board. Some form of tap should inserted in the tube, as shown, stop the air. If the tube is of bber and no tap is available, it n be kinked in the hand to stop e air.

OWING BOARD

The blowing board consists of a t piece of wood with a hole in the ntre. The area of the board de- nds on the size of the sheet to be wn.

The surface of board is covered th a thin sheet of brass and the d of the tube for the air supply ould be soldered flush to the hole the centre. The board should be ounted on blocks at each corner to e clearance for the air line.

The moulds for the blowing pro- ss are always female. If the shape be moulded is comparatively mple the mould can be made in od. It will, however, be found mpler, where a more complicated ape is involved, to first make a ale pattern and then to cast a male mould from it in plaster of ris.

When making a mould or pattern, arp corners should be avoided nerever possible. Shapes with large wing curves will be found to give e best results and to be the easiest blow. Where possible, lines rising rtically from the blowing board ould be avoided and withdrawal gles of at least 10 degrees should used.

ASTING BOX

As the mould has to be clamped wn on the base board, it is impor- nt to arrange wooden supports in to take the pressure of the clamps. ne simplest method of building the oulds is to have a casting box as own in Fig. 3. This consists of a ctangular box with one face open nd a pouring hole opposite the open ce.

The pattern is first greased to event the plaster sticking and then e casting box is placed over it and e plaster poured in. When the aster has set the pattern is remov- and small air holes drilled through e plaster at the top of the mould allow the air at the top of the ould to escape during the blowing peration. The mould is then ready r use.

It is essential in the blowing oper- ion that the mould is clamped idly to the base board. Clamps the type used by woodworkers are eal for this purpose, but if they e not available, any method that ill hold the mould firmly, and hich can be applied quickly, may used. It is important to realise at a considerable load is exerted the mould in the blowing process nd the clamps should be strong nough to withstand it.

(Continued on Page 103)

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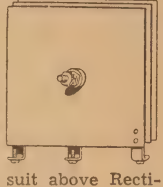

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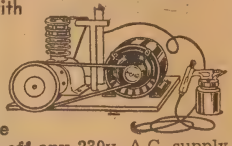

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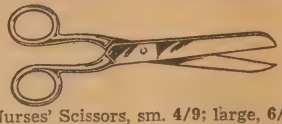

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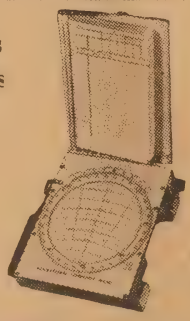

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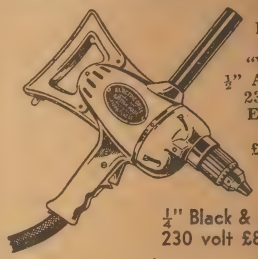

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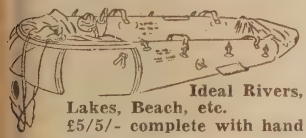

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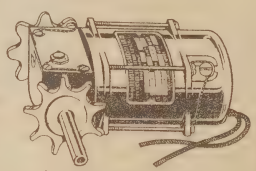

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MAKING A SMALL ELECTRIC MOTOR

Electric motors are apparently one of the most popular types of models with our readers. They come in all sizes and shapes. Here is another design which incorporates some ideas capable of elaboration.

THIS simple electric motor is designed to produce a relatively high power on a very low voltage (1½-6) for small model motor-boats, and can be built quickly and easily by any handyman with the minimum of tools. It has been tried out and it works efficiently.

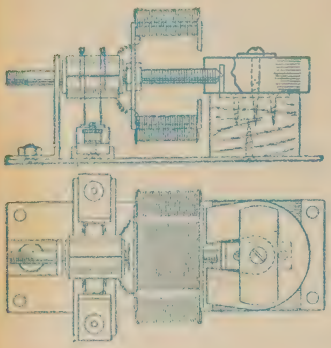


Fig. 1.—Side elevation and plan of the completed motor.

First of all, a small magnet must be bought, which is obtainable in most tool shops or model makers' supply stores. This is clamped to a small block of wood, which in turn is screwed to a metal base, as in Fig. 1.

The armature core is cut from a piece of soft iron sheet about 1-32in thick (Fig. 4) and bent at right angles on all dotted lines to the form shown at A (Fig. 5). Small, thin pieces of brass are bound on with insulating tape or gummed paper, as shown at B, for keeping the armature windings in position when these are completed.

THE COMMUTATOR

A centre hole is drilled to take the axle and tapped 4 BA. Each arm is carefully wound with eight layers of No. 26 DCC copper wire all in the same direction, leaving a loop of wire between each arm for connection to the commutator. The two finishing ends are joined together to form the fourth loop. When the windings are all neatly finished, cover with a liberal coating of shellac varnish and bend the brass pieces up and over the ends of the windings to prevent them from slipping. (See Figs. 1, 2 and 3.)

To make the commutator, take about 2ft of thin gummed paper and cut this to 7-16in in width, damp, or, better still, gum along its entire length and roll this tightly and evenly on to a slightly vaselined 1-8in piece of rod (the smooth shank of a drill will do), slide off, and leave to dry for 24 hours.

Before sliding off, however, make sure it is going to fit fairly tightly into the short length of brass tubing that is to be used for the commutator. This tubing should be about 3-8in diameter and about 7-16in long, of light gauge. A piece of old brass gas tubing will do.

When the paper roll is perfectly dry and hard gum the surface with a strong adhesive and force into the tubing again, leaving to dry very thoroughly with a little of the paper roll protruding at each end. When quite dry, cut the brass lengthways into four equal segments with a fretsaw. This forms the commutator, the hole for the axle being exactly down the centre.

The axle is a piece of steel rod 9-64in in diameter, and is threaded 4BA half-way along its length to take the armature, and at the other end to take some form of coupling to the propeller.

For those readers who have no taps and dies, both the armature and the coupling to the axle can be soldered with equally good results, but it is not so handy for taking to pieces or for final adjustments.

The armature is now screwed on to the axle with a nut on each side

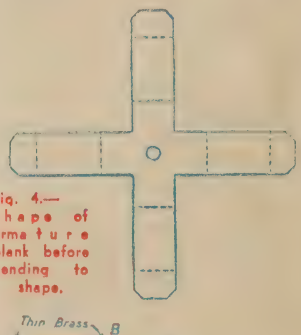


Fig. 4.—Shape of armature blank before bending to shape.

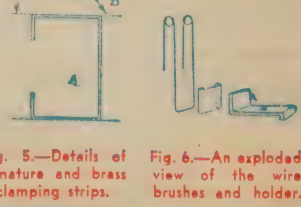


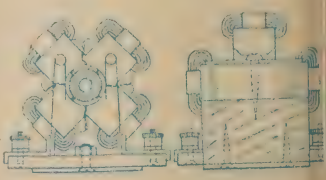
Fig. 5.—Details of armature and brass clamping strips.

Fig. 6.—An exploded view of the wire brushes and holder.

to keep it square with the axis, ar the commutator is forced on close it (Fig. 1). In the top half of th illustration the two side arms the armature are omitted in t sketch to show the nuts and screw axle.

The end of the axle nearest the field magnet is carefully fil to a point of about 45 deg., whi is pivoted into a bearing made of piece of odd brass, bent at rig angles, countersunk into the blo of wood supporting the field magn and drilled half-way through on i vertical surface to take the point the axle (Figs. 1 and 2). The oth bearing is just a piece of brass be at right angles, bolted to the ba and drilled 9-64in to fit the pla part of the axle.

The windings are now solder to the commutator sections by twis



Figs. 2 and 3.—Front view of the motor (with bearing plate removed), and rear view.

ing each loop of wire tightly ar soldering to the commutator segme nearest to it. Finally, the com mutator is adjusted to the positio shown in Fig. 3—the cuts opposi each respective leg of the armatur (The outer bearing is left out he to show the brushes and commutat details.)

THE BRUSHES

Many ways of making the brush have been tried, and the followi method has been found most effe tive. An exploded view is show in Fig. 6. This consists of a fe inches of thin piano wire, about gauge, carefully bent as shown, wi a single turn at the top to make t brush more springy. A small pie of very thin brass or tin is now be round each leg and the flat side the brass is then soldered to t brush-holder and terminal str (Figs. 1 and 3).

A small thick strip of ebonite, ha wood or fibre is now cut and drill and the terminals fitted, which clam the brush-holders firmly down, t

(Continued on Page 102.)

POINTS ABOUT THE BENCH VICE

nch vices are used for all neral work in the workshop d vary in size, weight and ttern to suit the many and rious types of work which they ay be called upon to do. The oblem then arises to choose vice to suit the particular type of work you have in mind.

E ordinary bench vice has hardened steel parallel jaws h are secured to the jaws formed he body of the vice. The jaws moved together or apart as re- ed, by means of a lead screw h is operated upon by a handle. s of this type can be bought in ous sizes ranging from very l to very large but the usual for general workshop use has from 3in to 4in wide.

refinement to a bench vice is ick-release device which allows front jaws to be moved back- d or forward as desired without ing the handle. A split nut h is opened by means of a lever the end of the lead screw bar, tted.

e offset bench vice has the jaws set and it is particularly handy gripping angular or wide work. lso allows long objects to be ped vertically.

In setting up any vice on the bench, make sure that the jaws are level and that it is bolted firmly in place. Place the front of the back jaw slightly out from the level of the bench so that long work can be gripped. The top of the jaws should be at elbow level which is about 40 inches, in an average case.

Always place a pair of soft jaws, either lead or copper, in place where the work is likely to be damaged when clamped in position. Finally, never hit the handle of the vice with a hammer to tighten it or use the vice as an anvil.

SHORT WAVE NOTES BY RAY SIMPSON

AUSTRALIAN STATIONS SCORE WELL IN S.W. POPULARITY POLL

In the June issue we mentioned the Short Wave Station Popularity Poll being conducted by the International Short Wave Club in England and the results of this poll have just come to hand. The purpose of this poll was to discover which of the international short wave stations was the most popular in the opinion of listeners generally.

BY courtesy of Radio Australia we have now received the full results, and it was very gratifying to note that our own station, Radio Australia, was awarded second place.

The full results were as follows: 1st, OTC Leopoldville, 609 points; 2nd, Radio Australia, 446 points; 3rd, Switzerland, 435 points; 4th, Radio Canada, 419 points; 5th, Overseas Service BBC, 401 points; 6th, PCJ Hilversum, 388 points; 7th, Voice of America, 380 points; 10th, SRI Buenos Aires; 11th, HCJB Quito; 12th, FZI, Brazzaville; 13th, All India Radio; 14th, TAP, Ankara; 15th, RUL, Boston; 16th, Monte Carlo; 17th, Radio Norway; 18th Radio New Zealand; 19th, Radio Andorra; 20th, Radio Rome; 21st, Radio Indonesia; 22nd, Radio Luxembourg; 23rd, CR7BE, Mozambique; 24th, FBS, Malta; 25th, Radio National Espana; 26th, TGWA, Guatemala.

With such strong competition as the above stations it was certainly a very good effort of Radio Australia to fill second place, and must be a source of great satisfaction to the officials of the station. Personally, we think the DX session conducted by Graham Hutchins would be a contributing factor to the high number of votes polled by Radio Australia

SHORT WAVE NOTES for the September issue are due on August 5. For the October issue they are due on September 9. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

FLASHES FROM EVERYWHERE

NEW STATIONS IN INDONESIA

INDO-CHINA: The well-known station which we used to know as Radio Saigon, but which lately has changed its title to Radio France-Asia, has recently changed frequency from 11.84 mc to 11.83 mc as a result of a suggestion made by Art Cushen, of New Zealand. There is a certain amount of interference from VLW3 until that station closes, but is then in the clear.

However, despite this change, the Saigon station was to move back to 11.84 mc on the night of June 30 when it dedicated its listeners programme to the N.Z.D.X. League. At time of writing the station is being heard faintly on 11.83 mc, but not as well as it was in the days before the war.

BRAZIL: We are indebted to Radio News and Television for the following item regarding Brazil. The Police Department of Rio de Janeiro is now using a new channel, 9.29 mc, and operating under the call sign PRN9. They transmit daily, except Monday, from 8.30 am to 9.30 am, so it is quite possible to log them out here. Do not mistake this station for PYZ2 on the same frequency and mentioned elsewhere.

There is also news of another new Brazilian known as Radio Difusora Acreana, Rio Branco, capital of the Territorio do Acre. It has been heard in the USA on 4.115 mc from around 10.30 am, but we are afraid on this particular frequency it would be inaudible at this time in Australia.

NEW CALEDONIA.—The well-known Noumea station, La Voix de la France dans le Pacifique, which operates on 6.035 mc, is being heard at very good strength in Sydney and seems to have extended their transmissions as on one particular night we heard them till as late at 10, while on other nights they have been on the air till around 9.

In a recent verification from the station one of the station officials, Monsieur Freddy Drilhon, advised us that they soon hoped to broadcast a one-hour programme each day in English and asked for opinions as to whether it would be appreciated and whether we listened to the station regularly. We should imagine that an English hour would meet with great approval.

INDONESIA: Arthur Cushen was the first reader to tell us about some new shortwave stations which have recently commenced operations in various towns in Indonesia. The first of these, a 1000-watter, is located in Surakarta and uses 3.332 mc, while four others, all with a power of 300 watts, are located in Madium, Java, on 4.16 mc, Kediri, Java, on 3.51 mc, Jogjakarta, Java, on 3.7 mc, and Kotaradja, Sumatra, on 8.91 mc.

We have not yet heard any of these stations at our location, but, as mentioned in the new station list, we have heard YDM, in Bukittinggi, Sumatra, on 7.235 mc. There are a great number of Indonesian stations between 2.5 mc and 5.0 mc, but it is very difficult to identify them.

NEW ZEALAND: The New Zealand Broadcasting Service has recently sent out a very attractive folder giving the latest details regarding the transmissions from Radio New Zealand. They are now operating on ZL3, 11.78 mc, and ZL4, 15.28 mc, from 4 am till 9.20 pm, with the exception of five minutes between 4.55 pm and 5 pm.

The session from 5 pm to 8 pm is titled Calling Australia and the Islands, while the balance of their transmission is a re-broadcast of the N.Z.B.S. home stations. They say, "Our programme policy is substantially the same as when the New Zealand Short Wave Service was inaugurated—first to give listeners musical programmes and secondly by the spoken word, to interpret New Zealand to people in other countries."

ARGENTINA: We learn from the latest issue of the N.Z.D.X. Times that Argentina has purchased two 100 kw transmitters which are to be used in parallel. We should imagine that when these transmitters are in operation they will provide a very powerful outlet for the Argentine authorities.

Quite likely they will be used by the S.R.I. organisation, which gives us some very entertaining English programmes from LRY in the afternoons. Also from the N.Z.D.X. Times we see that Denmark, Egypt, Finland and India have also ordered 100 kw transmitters, so there will certainly be some very strong signals on the air before very long.

Can You Identify These Loggings?

For some time now we have been tr to identify a number of Latin Amer stations heard every night around the metre band but at time of writing th are still a few which have us puzzled. H are details as far as we have been abl gather and perhaps some listeners may able to help.

5.955mc: This station is definitely loc in La Paz, Bolivia and their slogan sou like "Radio Confucion," La Paz. T come on the air at 10.0 pm, with mus number followed a few minutes later announcement, more music then news Spanish till around 10.30 pm. Do mistake this one for 4VRS in Haiti wh can be heard earlier on the same chan

5.965mc: The station on this channe a Colombian and comes on the air aro 9.45 pm to 9.55 pm and gives call long and short waves. The first th letters of call are HJC and the last sou like either T or P. Just after opening t give a BBC English lesson which c sists of a conversation by lady and g in alternately English and then Span Music follows just after 10.0 pm and t news in Spanish.

6.015mc: There is another very in esting new one on this frequency wh opens regularly at 9.55 pm, with a ma followed by the usual Buenos Dias station announcement. This one is loc in San Salvador, El Salvador and this easily be followed from the announ ment. They give their call which sou like YSG, though on other nights resembles YST. They have a distinc tune just after opening which someti is preceded by chimes and clock strik 5. Their call letters are given again after 10.30 pm.

6.025mc: Still another new one on channel which opens right on top Kuala Lumpur at 10.0 pm. Announcem is given by lady and then marimba t music follows till station fades out aro 10.45 pm. We have never been able to much from the announcement as heterodyne whistle is very bad. Our gu for this one is that it is a new statio Guatemala or alternatively one mo from another frequency.

From 6.0mc these nights is very crow at 10.0 pm, as there is HJKD on 6.0 HP5K on 6.005mc, HSPD on 6.010mc, Salvador one on 6.015mc, HJCX on 6.018 Moscow on 6.020mc, Kuala Lumpur the new Latin on 6.025mc and t HP5B on 6.030.

There are also a couple of Latins mi up underneath VL12 which possibly Brazilians. From 6.0mc to about 6.4 is very interesting these nights and careful listening you can log many stations.

STATION ADDRESSES

ATHLONE: Office of the Engineer Chief, Dept. of Posts and Telegra The Castle, Dublin, Eire.

OLR: Czechoslovensky rozhlas, St nova 12, Prague XII, Czechoslovakia.

PARIS: Radiodifussion Francais, Av. Champs-Elysees, Paris 8eme, Fra

CR6RE: Radio Clube de Malange, C Postal No. 83, Malange, Angola.

EA8AB: Radio Club Tenerife, P.O. 225, Santa Cruz de Tenerife, I Canarias.

ZOY: Broadcasting Department, Ac Gold Coast.

ZJM4: Near East Arab Broadcas Station P.O. Box 219, Limassol, Cyp

YI5KG: Iraq Government Broadcas Station, Bagdad, Iraq.

FXE: Lebanese Broadcasting Stat Beirut, Lebanon.

COBC: Radio Progresso, San Jose Havana, Cuba.

XEOI: Radio Mil, Fomento de Radio Donato Guerra No. 26, Mexico C Mexico.

cord month for w call signs

HOUGH perhaps not an all-time re-rd for the greatest number of new ns heard in one month, these last weeks have certainly provided a d selection of new loggings, plus which we have included as they not been reported for quite a num-f years, and will be new ones to listeners who have only taken up obby since the war.

TISH GUIANA: A few months ago writer included ZFY as one of the ns which had defied reception over nber of years at our location, though em to remember that one or two s have heard it at odd times. During atter part of June we were, there-very thrilled when we heard it on consecutive nights when it came e air at 8.15 pm on a frequency of c. All announcements are made by ly, the opening one being "Good ing, everyone, this is station ZFY eorgetown, British Guiana."

summary of the programme to fol-s then given, recordings then being d until 9.0 pm, when they cross to BC for the news. In the summary oticed such programmes as Music You Work and Moments of Melody. gth of signal is not very great and s to fade from opening, and, in ion, there is interference from the se station on 5.985 mc. This one till be heard on a favorable night, so ter it right away.

RINAME: Here, again, we have a n that has actually been heard in alia (Ted Whiting heard it during war if we remember correctly), but still another of the "hard" ones we The station in question is PZC ramaribo, Suriname, which operates 5,405 mc. We have only heard it on a Saturday forenoon, when it ne audible around 10.15 am.

that time they were playing Indian music (exactly the same as heard Delhi), this being, we understand, gular weekly feature for Indian lis-s in Suriname. Normal Western type e is then given until station closes 30 am, with the well-known Dutch nal Anthem. All announcements g latter part of programme are in n.

NGARY: This is not an entirely new n, but a well-known one operating new additional frequency. The omer is Budapest, which is now using mc, in addition to 6.247 mc and 9.83 which have been heard for some now. When first heard on this new nel they were giving a programme in sh at 9.15 am, which consisted of in English, followed by a news com-ary till station left the air at 9.30

ength of signal was quite fair, gh not at such good level as they n 9.83 mc at 7.0 am. Incidentally, we ve they are also using 11.91 mc at hour, also in English. They seem ppreciate reports, so here is another one to write to.

AZIL: Moving now to South America ave two new ones from Brazil, the and loudest being PYZ2 on 9.29 mc, h is operated by the Departmento ral de Seguarnca Publica, and which been logged on two or three morn-from around 9.30 am till after 10.0 when it fades out. Programme con-of both music and talks in Portu-e, with frequent mention of Brazil.

e other one is PSL on 7.94 mc, h has been heard on two occasions ne weekend around 9.0 am. Here, , the programme consisted of both c and talks and seemed to be of special nature. This station is lo-d in Rio de Janeiro, and is operated he Department of Press and Propa-a.

LY: Every month now we seem to one or two new Italian stations to nicle, and this month it is Radio na on 6.01 mc and also on 9.575 mc. latter frequency was heard for some with the Arabic programme from nd 6.30 am, but recently we have noticed the move to 6.01 mc with the same programme, followed by a programme in German commencing at 7.0 am.

The 6.01 mc channel is very good and the station can easily be recognised by the familiar birds whistling prior to the commencement of the programme. In addition to the above new frequencies they are also still using both 9.63 mc and 11.81 mc, also on odd occasions either 11.9 mc or 15.315mc.

COLOMBIA: For some time now Art Cushen has been reporting HJKD in Bogota as being heard well in NZ until they close in the afternoon, but there were no reports of it being logged in Australia. It is now our turn, however, as this station is now being heard at very good strength every night opening at 10.0 pm on 6.0 mc.

They play a stirring march followed by announcement in Spanish, which gives their staiton title Emisora Nuevo Mundo. They appear to give news in Spanish until 10.30 pm, interspersed with short musical numbers and advertisements. At 10.30 pm the call-letters are given again both long and shortwave, and once again followed by Emisora Nueva Mundo.

PANAMA: Our NZ friend, Art Cushen, is never far behind when new stations are around, especially the Latin Americans, and it is thanks to him that we make mention of HOQQ in Panama City. Art has been hearing this one of late conducting test programmes on 6.14 mc opening at 9.0 pm.

Evidently we were too late to hear it, as, although we have checked the channel on most nights, there has never been any sign of HOQQ. This one is known as Radio Nacional, so if you should hear that announcement on 6.14 mc you will know who it is.

Speaking of Panamanian stations, HP5B Radio Miramar is now being heard very well every night from around 9.0 pm and no difficulty should be experienced in identifying it.

TURKEY: Widely reported by both Australian and New Zealand listeners is the new 100 kw station of Radio Ankara. They appear to be using two new channels, namely, 9.515 mc and 17.84 mc, times on the air being 6.25 pm-7.0 pm; 5.40 pm-8.0 pm; and 9.0 pm-10.0 pm. At time of writing we have not heard either of these stations so cannot offer our opinion as to whether they are known as TAT and TAV or the reverse.

However, these two calls seem to be the accepted ones just now, but will probably be clarified by next issue. Turkey is also assigned to 7.285 mc, 11.88 mc, 15.16 mc, and 21.66 mc, so it would be worth while to watch these other outlets as well.

MISCELLANEOUS: Summarising the other new stations recently heard, we notice Manila using 6.12 mc at night, Damascus at 7.0 am, with announcement in English on 9.525 mc, and Tangier at 8.0 am on 6.06 mc. Still another Latin American is YSO Voz de Democracia in San Salvador, heard on some nights at 10.15 pm on 7.315 mc.

Tahiti made a move from 12.08 mc to 9.05 mc in their afternoon transmission, but have now changed back to 12.08 mc. Lourenco Marques has been logged at great strength in afternoons till closing at 4.0 pm using 9.575 mc, but no call letters were heard. This about sums up the new ones with the exception of the unidentified which are commented on in another paragraph.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time Heard
ZFY	5980	50.17	Georgetown, British Guiana	8.15 pm
HJKD	6000	50.00	Bogota, Colombia	10.00 pm
ROME	6010	49.92	Rome, Italy	7.00 am
TANGIER	6060	49.50	Tangier, Tangiers	8.00 am
MANILA	6120	49.02	Manila, Philippines	9.00 pm
HOQQ	6140	48.86	Panama, Panama	9.00 pm
YDM	7235	41.47	Bukittinggi, Sumatra	9.00 pm
YSO	7315	41.01	San Salvador, El Salvador	10.30 pm
PSL	7940	37.80	Rio de Janeiro, Brazil	8.30 am
FZP	9050	33.15	Papeete, Tahiti	2.30 pm
PYZ2	9290	32.29	Rio de Janeiro, Brazil	9.30 am
TAT	9515	31.53	Ankara, Turkey	4.30 pm
DAMASCUS	9525	31.50	Damascus, Syria	7.00 am
ROME	9575	31.33	Rome, Italy	7.00 am
CR7BE	9575	31.33	Lourenco Marques, Mozambique	3.30 pm
4VEH	9890	30.33	Cap Haitien, Haiti	10.00 pm
BUDAPEST	11910	25.19	Budapest, Hungary	9.15 am
TAV	17840	16.82	Ankara, Turkey	11.00 am

Two latest station verifications

IN an interesting letter from Mr. A. G. Aslat of South Australia, we have some details of a recent verification he has received from ZYB9 in Sao Paulo, Brazil. Their verification is in the form of a folder showing a map of the world in green on the front with a hand shake above it. The wording on the front is "Hail to a new Friend" and the equivalent in Portuguese, "Saludamos un nuevo Amigo."

Inside the folder they set out their station details which states that the station belongs to Emissora Associdao the largest radio network in South America, having a total of 24 transmitters. Sao Paulo is the capital of the state of Sao Paulo and they go on to give some details of the country such as population, 8,847,010 largest coffee producing centre in the world. They then list their various transmitters, PRG2 1040kc, PRF3 960kc, ZYB7 6095mc, ZYB8 11.765mc, ZYB9 15.155mc, and PRF3FM 89.333mc.

EDVIO: After a long delay, a very attractive card has arrived from EDVIO "Radi Seu" Madrid. The card is printed in Red, Yellow, Black, and White and shows call letters superimposed on horizontal colored bands and also states that frequency is 7.17mc with a power of 1kw. On the reverse side of the card they give their thanks for our report of 12th August, 1948, and confirm reception as being correct.

NEW HAITI MISSIONARY, STATION 4VEH

A WELCOME addition to the comparatively few Haitian stations is the new missionary station 4VEH. This newcomer operates on a frequency of 9.89mc and can be heard nightly when it comes on the air at 10.0 pm. After opening announcement in Spanish they identify themselves in English as follows, "This is station 4VEH in Cap Haitien, Haiti."

They then go on to say that reports from listeners would be appreciated and should be sent to Radio Station 4VEH, P.O. Box 1, Cap Haitien, Haiti. Their programme consists of hymns and choral numbers by a mixed choir, interspersed with announcements in Spanish, followed at 10.30 pm, with a further identification in English.

SHORT WAVE & B.C. DX FANS

Do you realise what "Spherotune" Coils can do for you?

"Q PLUS" Spherical particle iron dust cores are available for operation up to 200 megs.

SHORT WAVE COILS

TYPE

SWA 13 — Aerial Coil Spherotuned 13-42m 5/9

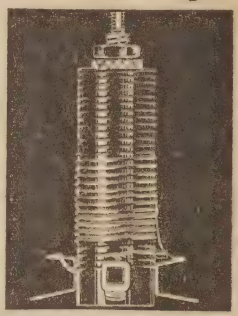
SWA 16 — Aerial Coil Spherotuned 16-50m 5/9

SWR 13 — R.F. Coil Spherotuned 13-42m 5/9

SWR 16 — R.F. Coil Spherotuned 16-50m 5/9

SWO 13 — Oscillator Coil Spherotuned 13-42m 5/9

SWO 16 — Oscillator Coil Spherotuned 16150m 5/9



Illustrated herewith the new "Q PLUS" Short Wave Coil.

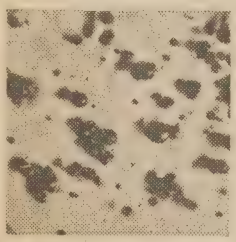
BROADCAST COILS

AC5 — Spheroclad B.C. Aerial coil 9/6

RC5 — Spheroclad B.C. RF coil 9/6

IF8-9 — 1st & 2nd IF Spheroclad 14/9

N.B. All midget aerial & RF coils and IF's are of the Spheroclad construction.



Carbonyl Iron powder at 750X. The spherical shape is clearly seen.

"Q Plus", "Spheroclad" and "Spherotune" Coils are made from the exclusive "Carbonyl" series of powders which as the accompanying illustration shows have spherical particle shapes.

This enables the very important insulation to wrap itself around each individual particle and so when compressed the eddy current loss is much smaller.

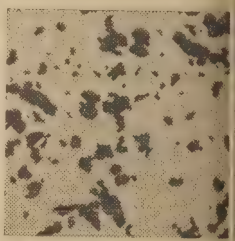
The Formula:

$$P = \frac{n^2 t^2 f^2 Bm^2 p \times 10^{-7}}{20_p} \text{ watts/cm}^3$$

Shows that these losses are increased to the square of frequency and particle size.

Need we say more, when we refer to Short Wave frequencies. Compare the accompanying microphotos for respective particle size and you will see for yourself why the overall "Q" factor of "Spherocore" Short Wave coils is superior.

In the new 1950 Short Wave Coil series a tuning wand of only ¼in. diameter is used in place of the old 3-8in. diameter which results in even less losses being introduced into the coil.



Hydrogen-reduced iron powder 500X. Particle shape is irregular.

SPECIAL UNWOUND UNITS FOR "WIND YOUR OWN" ENTHUSIASTS

At the present moment only coils for the 16-50 meter and 13-42 meter band are available BUT foreseeing the demand for special band needs "Q PLUS" have released the unwound coil units complete with mounting, terminal and Spherotune core.

RETAIL PRICE, each 2/-

ALL FORMERS ARE MADE FROM LO-LOSS POLYSTYRENE

SUPPORT "Q PLUS" AND THEY WILL SUPPORT YOU WITH EVER INCREASING QUALITY AND LINES

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THE HAM BANDS WITH BILL MOORE

During the most disastrous floods ever experienced in NSW, which occurred on the North Coast and Hunter Valley in late June, Radio amateurs organised the largest emergency radio net ever to operate in Australia. From as far north as Lismore and south to the Hunter Valley, stations were active in handling messages of vital importance.

E net operated for nearly a week. Some of the operators were active n their home stations until driven by flood waters. They, then, in most s. continued the good work, using ery-operated equipment.

all, some 17 stations in the flooded as on the North Coast were active in net, performing a marvellous task the relief of the public and assisting various authorities to restore normal lities.

mateurs throughout the State co- rated fully, and many stations out- the affected areas did sterling work allow the net to function so effectively. n the North Coast the net operated n midday, Friday, June 23, to mid- l, Thursday, June 29. In the Hunter lley the emergency net was alerted members stood by for a similar od awaiting any call for assistance.

he whole operation could do nothing reflect the greatest credit on the rators who participated, and on nteur radio generally.

ERATING BANDS

ost of the operating was conducted the 7mc band by day and the 3.5mc d by night. However, quite an amount work was done crossband to Forestry ay and Aeradio frequencies.

he full story will not unfold until the teurs who participated have com- ed logs, and it is hoped that the full ailed account will be soon published Amateur Radio. Some amateurs had ee receivers operating simultaneously separate frequencies in an endeavor keep track of the operation.

lessages were handled for the PMG, ice Department, Clarence River County uncil, with reference to the repairs restoring of electricity supplies, NSW vernment Railways, Press for various wspapers, Army, DCA and various other ies. Message tallies reached very high els, VK2PA, for instance, handling rly 600 messages, and the grand total well over the thousand mark.

tations operating from the flooded as included Doctor Hewitt, from Lis- e, VK2LH; Grafton—Roy Berry, 2NY, Peter Rudder, VK2TB, and Geoff. tzer, VK2SR; Casino—Charlie Miller, 2ADE; Coff's Harbor—Jack Vardy, 2JK, and Len Turner, VK2AJB; Bel- en—Harry Hine, VK2ARY, and Nor- i Hart, VK2AAP; Raleigh—Crieff Ret- ck, VK2XO; Port Macquarie—Peter xander, VK2PA, Doug. Gill, VK2SH, Lee Smith, VK2AWS; Kempsey—Col tcher, VK2ASF, and Gerry Challender, 2ZS; Taree—Bill Eagling, VK2AEY.

uite a number of the above amateurs rated their home station until the d waters drove them out, and then tinued the good work, using battery- rated equipment from other locations.

OFTOP RESCUE

rieff Rettalick, VK2XO, for instance, driven to the roof of his home, but naged to get his No. 11 going, and, identally, arranged for his family's cue via amateur radio. Harry, 2ARY, arranged for a boat to go down collect them and other families.

Kempsey it was decided to set up ee portable transmitters in the town districts as the three sections would isolated.

erry Challender, VK2ZS, operated his in transmitter with emergency power ply. Col Fletcher, VK2ASF, who was heard so much on amateur bands, a great job on Forestry and PMG ergency net frequencies. Mervyn Harrison, of DCA, operated the third transmitter—an FS6—from Gladstone and handled over 100 important messages. The three stations kept the areas in communication with one another, while VK2ZS handled most of the traffic to the amateur net.

Port Macquarie was the centre of the net operation, where Peter Alexander, VK2PA, North Coast emergency officer, acted as control officer. He was assisted by Doug Gill, VK2SH, and Lee Smith, VK2AWS.

The value of a control station in a central position, with normal power available, was clearly demonstrated, and Peter's efforts in relaying traffic from the portable stations to official stations VK2AA, PMG and VZSY Sydney Aeradio, was invaluable.

Under VK2PA's control the whole net operation was excellent from every viewpoint.

Grafton was another spot where the floods drove the amateurs from their homes. Roy Berry, VK2NY, Peter Rudder, VK2TB, and Geoff Switzer, VK2SR, all did good work until the floodwaters rose. Chas. Miller, VK2ADE, of Casino, from then on took the traffic for Grafton and passed it along by landline.

A Newcastle link was also operating and Jim Cowan, VK2ZC, Harold Whyte, VK2AHA, and Ron Stuart, VK2ASJ, were active, providing a channel from the North Coast to the Newcastle police, Aero Club and RAAF.

Inland from the coast, VK2JC, VK2HC and VK2APS supplied vital weather information from areas that affected river heights.

Many other stations—too numerous to list in detail—were active in various ways, assisting the effective operating of the net.

STRANGE CALLS

There were many strange calls on the amateur bands — Army ducks, aircraft, postmasters, commercials — but it all added to one thing—relief for those in distress. It was interesting to note that the operator of VZSY, Sydney Aeradio, for most of the time was Chas. Peddell, VK2KN, who did such fine work in Kempsey during the previous floods.

During the North Coast working, members of the Hunter Valley Emergency Net were standing by as river levels rose along the Hunter. The normal communication channels held and their services, fortunately, were not required. River heights readings for the police were, however, supplied as requested.

Stations from Muswellbrook to Maitland were active, including VK2ANU, 2VU, 2JZ, 2ADT, 2AKP, 2XQ, 2TY and 2DG.

A link was also supplied from Maitland by VK2AKP to Newcastle and then to the North Coast, allowing Army duck stations there to communicate with their base.

A number of valuable lessons were learnt from the operation, and they can well be applied in future emergency working.

The value of effective control, as mentioned previously, was clearly demonstrated. If at any future emergency working a greater amount of traffic is handled, the possibility of split control may have to be considered. The channel was very close to saturation on a number of occasions, and with two channels operating—one for traffic from emergency stations and the other from traffic to official stations—the position would be improved.

It would be necessary for the two stations to be linked on, say, 50 mc—similar to the auxiliary 50 mc channel used by Forbes stations in the western floods. The idea could be tried out during net practice operations to test the possibilities of the system.

The wisdom of running emergency net practices on the emergency frequencies of 3501 and 7002 kcs. is doubted. During the Sunday morning, interference was caused to emergency working when the Victorian net opened on practice. This was not the fault of the Victorians, as they would not be able to hear the lower power emergency stations, but their signals were strong enough to cause some worry. They, of course, moved quickly when informed of the position.

As usual in such work, there were a few too many helpers. Hundreds of receivers were tuned to the net but just a few amateurs couldn't resist the idea of breaking in and offering assistance. It is generally quite clear when assistance is required, and it would be safe to say—unless requested, don't break in after the net has been established. The control officer is busy enough without exchanging felicitations with all and sundry.

AMERICAN PROCEDURE

WITH so much activity in the emergency field here in Australia during the last 12 months, the problems that have arisen in similar operation in the United States offer a number of lessons.

Over there the Amateur Emergency Corporation is an organisation sponsored by the ARRL and has groups set up right across the continent. The following criticism is as a result of continued operation in the emergency field.

One problem has been the duplication of messages and lack of authentication of reports and messages during emergencies. Emergency communication is often conducted under conditions of confusion and it is extremely difficult to obtain authentication for messages.

When a mobile station reports from a disaster area, that such and such a condition exists, if there is no official present, the report is only the operator's opinion. Sometimes the operator's judgment is faulty, sometimes good—the officials away from the area have no way of knowing.

If the messages were signed by someone in authority there would be no time-wasting attempts to find out from someone in authority what the real facts are.

When ever possible, messages coming from within a disaster area should be signed by someone in authority. They should be complete as to form, and copy, and should be sent to one station only.

In emergency it is the amateur's primary job to supply communication facilities, the contents of the messages should come from someone else.

The possibility of duplication should be avoided if practicable. Amateurs who hear an emergency message being sent, should make a note of the contents, but should not deliver the message unless it is being sent to them. Then, if the station it is being sent to cannot receive it, it could be forwarded, but only after

originator of the message has been med. Duplication of messages in ral only means a waste of some- 's valuable time.

e most important thing is to get messages through, and no specific or procedure are possible. An ator using a walkie-talkie set cannot off a copy" of a message he origin- neither can a transmitting station out a receiver transmit a call for and hear the acknowledgment of pt.

have to do what we can with the ties we have, and between emer- ies, strive for better facilities and efficient operation of them.

o things should be closely watched— that no messages be duplicated g handling, secondly, that all mes- , especially those concerning relief, ld be signed by somebody in ority.

ENGLISH LICENCES

GOOD comparison of the amateur regulations operating in England and in use here can be obtained by re- ing present negotiations between the Society of Great Britain and the

u will see that quite a number of ities available here are not allowed nglish amateurs.

er 12 months ago the G's lost their band to television. Since then RSGB has been endeavoring to obtain nd around 72mcs. Amateurs in the R and France have already obtained privilege and it is hoped the same ity will become available in England.

e RSGB has also been negotiating btain permission for amateurs to con- television experiments on certain uencies in the 420mc band. At the ent a special experimenter's licence equired for such work, and special ication has to be made. These special ces are costly and only issued for a ricted period.

r three years now the GPO has been idering the possibility of issuing ne mobile licences to amateurs at The privilege is granted in most r countries, especially in USA, and in Australia. The RSGB hopes to n a decision shortly.

nder the terms of the new Wireless graphy Act, the GPO has decided ntroduce a new licence and, to date, ould appear that the conditions under ch the amateurs will operate will even more stringent than at present. uoting one point—that of second oper- s—the following is the proposed con- on. "Provision is made for a station e operated by the licensee or excep- ally and infrequently in the presence the licensee, by the licensee of any r amateur station licensed by the ." That is certainly restricting ac- ted operating practice.

Complaints of commercial interference in amateur bands brought the following statement from the GPO.

"It is not considered possible, that anything can be done to rectify the position of such interference until the Atlantic City frequency Allocations Table has been fully implemented. The Radio Branch, however, would be pleased to receive information on stations that regularly interfere on amateur bands." The RSGB has set up a special monitoring section under G6JJ to supply the required information.

W.I.A. NEWS

AT the July meeting of the NSW Division, superintendent Clifford, of the NSW Police, presented to Chas. Peddell, VK2KN, on behalf of the Commissioner, a certificate of merit for his services during the 1949 Kempsey floods. The superintendent, who is a member of the Flood Relief Committee, commented on the excellent work of the radio amateur during emergencies, and the fact that delegates from the WIA would meet members of the committee to discuss communication problems.

The lecture for the evening was delivered by Joe Reed, VK2JR, and his subject, Model Antenna Investigations on Low-Angle Radiation. The lecture was originally presented at the North Coast Convention at Urunga. The discourse was very much appreciated but left quite a few in attendance visualising an 80ft high Lazy-H in the suburban backyard.

OFF THE RECORD — NEWS & REVIEWS

The letter-box reveals just how much interest there is in the new, long-playing, micro-groove records, an interest which, judging from overseas periodicals, is even more intense in England. Most people realize that a major change is about to take place, but opinions at present differ as to the effect the change will have on gramophone listening as a whole.

By JOHN MOYLE

A COUPLE of letters received during the last few weeks are printed on page 102 of this issue, mainly because they raise what are probably the major points exercising the minds of many readers. It might be a good thing to comment on these letters in these columns, as of course they were addressed to me for such comment.

In the first place, might I make myself clear in my reaction to micro-grooves. Fundamentally, what I have heard leads me to believe that they hold such wide possibilities that I just cannot see the old 78 records standing up to the competition. I would say again that the long playing feature, assuming that quality is at least as good as with the 78 records, is sufficiently appealing to completely assure their position in the record scheme of things.

I am not, however, making a case that the records I have heard are beyond criticism, and are the ultimate in reproduction—far from it. On the contrary, for reasons I shall deal with presently, I believe that our approach to them in matters of equipment and handling will be just as different as I forecast they would be when the records were first released in America. Personal experience has only tended to strengthen my initial reactions, to underline the difficulties and drawbacks, and at the same time, to indicate what should be possible as time goes on.

However, let me refer first of all to the letter from Mr. Fitzsimmons who is worried that his new, high quality equipment for 78 records is now a bad investment.

NEW MODELS

No doubt the same reaction has passed through the minds of many motorists, for instance, when after having spent their money on a new car, they find a new model in the showrooms.

The car they have bought is still a good one—it hasn't changed a iota overnight. It will still give them service and enjoyment, spare parts will still be available should they be required, and petrol will still be on sale.

It is quite inevitable that buyers of the first micro-grooves will be upset when, soon after a purchase, a better recording becomes available. That happens today—I have many records in my collection which are rarely played because I have found later pressings so much better.

I do not think our friend's case is at all one for violent reaction. There is no possibility of 78 records being abandoned overnight, in favour of micro-grooves. In the first place there are far too many people placed exactly as Mr. Fitzsimmons is placed and who will remain steady 78 market probably for years to come. I, for one, have no intention of discarding about three 78 type motors and a collection of pick-ups, to say nothing of the records themselves.

IMPROVED 78's

I think it likely, too, that 78 records will be so much improved as to surfaces that the long playing feature may well be the major difference as compared with micro-grooves.

It is far more probable that the new records will supplement the older types for a long time, and in America, there are many new recordings being made available in both speeds. In the meantime, Mr. Fitzsimmons will be able to enjoy quite a period of good listening while his friends who decide to "go micro-groove" will undoubtedly enter an era of wrestling with surface, pick-ups, and the hundred and one maddening things which make the

n for the ultimate in sound so
ating, and so bad for the diges-

Young's angle is different, and
k he has posed a problem which
te a legitimate one. The same
sms of micro-grooves were
ed by Americans who first
them and to a less violent de-
I support them myself.

ing the month I have been able
y a new batch of records from
eas, and while they were by
eans as bad as Mr. Young's ap-
to be, they have convinced me
everything must be right with
-grooves if the best is to be
ed from them. I agree also
his being right includes every-
in the chain—the recording,
ressing, the pick-up, the motor,
to the amplifier and loud-
er.

ainst his reference to a "Gramo-
e" correspondent's letter, no
he has seen another in a later
of the same magazine from a
who has obtained some of the
Decca, English produced micro-
es. This man says that they
him the best reproduction he
ver heard from any source and
y medium.

is man is apparently also of a
ical turn of mind because he
in detail what I have just said
eneral terms. He talks about
superiority of diamond points,
nstance, because of their better
ing qualities even against sap-
s, and their ability to take a
point—so important where the
groove is concerned.

MOND POINTS

think therefore, that we can
nably assume that few in this
try have as yet had an oppor-
y of hearing how good the new
ds can be. I can see many tech-
problems which must be solved,
have indicated as much more
once. But I believe that these
lems will be solved, just as they
in the case of the 78 records.
etimes we can forget just how
some of the earlier records really
That's because clever men
ironed them out, one by one.
y, given a vinylite type of sur-
it is hard to fault a good record-
but to play it perfectly, atten-
must be given to precisely the
matters as are now proving
more important in the case of
micro-grooves.

Therefore I would say to Mr Young that his criticisms are probably well founded, and that his disappointment has been shared by many others. I am equally sure, however, that the day will come when he will be able to retract them all—when he is able to play a really good micro-groove on good equipment. That is, equipment which conforms in every way with the requirements of the new system, some of which may even yet be undisclosed

BETTER DISCS

This leads me to another matter which the new records may have underlined, and that is the problem of recording and reproducing an exceedingly complex waveform such as we get, for instance, when a full choir and orchestra are playing together at full volume.

There appears to be a fundamental failing of lateral cut records which it is hard to see being fully overcome, and that is the virtual impossibility of the cutter or the reproducing stylus to cut or reproduce a waveform with "sides" so steep that they represent virtually a cut at right angles to the groove itself.

Such a right-angled cut might be considered substantially occurring when a high percentage of high order harmonics have to be handled. The general conception of a fundamental note, as represented by a smooth sine wave, plus all its harmonics, is actually a square wave—one with vertical sides, and a flat top Imagine a needle attempting to follow such a curve traced out on a record, and you will see that it would in all probability tear through the grooves in a straight line, hopping over the right angled displacements in the process.

OTHER COMPLICATIONS

There are other implications bound up in this recording of complex sounds which are being realised overseas, and which give point to Mr Young's suggestion that wire or tape might be the ultimate answer.

Whether such a wide frequency range actually occurs in fact is something requiring more inquiry than I at least have done to date. But it might easily give a clue to certain mystifying distortions which occur in the attempt. It might be said that if the cutter can cut a given groove, then a needle should play it. But even if this is so, it does not follow that the sound contained in the groove will not be a harsh one when related to the original, even if the groove such as it is may be perfectly cut. Moreover we must not overlook the fact that the original sound may have been a harsh one as heard by the microphone, although to listeners in the hall, added reflections and subtracted attentuations taking place at the performance may have damped it down to an acceptable degree.

These are deep waters, but they all have a bearing on the ultimate acceptance or not of really wide range sound. Maybe I'd better leave the subject for treatment possibly at a future date when I have had time to learn and think more about it.

WIRE

Rubber covered wire, just the thing for extension speakers, indoor aerials, bell wires, etc. Available in 100yd. coils in Red, Green and Black.
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Special prices for large quantities.

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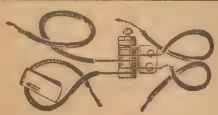

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U.S.A. Army full wave I.M.A. rectifiers—will work successfully on 5 M.A. Extremely small physical size—brand new. Easily worth 35/-, only, each **15/-**

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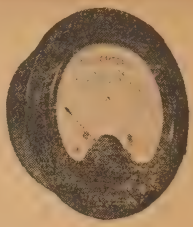
Note: All parcels sent registered post, unless otherwise stated. Postage must be included with order.



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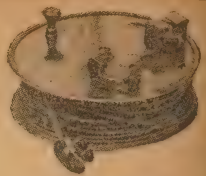

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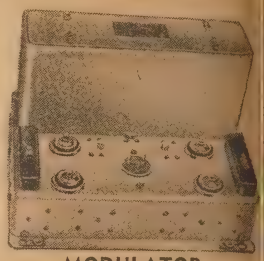

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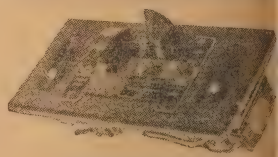

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M/S MOTOR SPARES LTD.
547 ELIZABETH STREET, MELBOURNE

Using an Output Meter

(Continued from Page 45)

for the output valve. If not
d the valve can, when fed with
ial, generate very high voltages
e plate circuit. These voltages
be large enough to arc over
en socket pins, or break down
ternal insulation of the output
former. Consequently a signal
d never be fed into the amplifier
s an appropriate load is con-
d across the transformer prim-
r secondary.

far we have only mentioned
ge output readings, which of
e have to be converted to power
t. To do this use is made of
simple formula, W equals E
ed, divided by R. For the bene-
those who are inclined to shy
of formulae, a few words of
nation are in order. W is the
r output in watts, E is the RMS
ge shown on your output meter,
R in ohms stands for the resis-
across which the voltage is
ured.

EXAMPLE

an example let us suppose that
have measured 50 volts a-c
s a resistance of 5000 ohms.
en the wattage is equal to 50
ed, divided by 5000.
is is equal to 2500/5000, which
s 0.5 watt.
w suppose we increase the gain
he voltage rises to 150 volts.
e wattage equals 150 squared,
ed by 5000. This becomes
0/5000 which equals 4.5 watts.
e provision of suitable load
ors may present something of a
em, particularly when it is
ed that these may have to with-
t power outputs of 30 or 40
s. Some of the odd value dis-
s resistors are very useful for
work. With a number of these on
it is usually possible to com-
them into the required value.
the resistors are mounted behind
minal panel, a few jumper leads
allow the wanted combination
produced quickly and easily.

nother job which entails the use
n output meter, is the taking of
iency response curves, and a
points are worthy of brief men-
at this juncture.

ONDARY SIDE

rst consideration is where the
surement it to be taken. The
l practice is to work on the
ndary side of the transformer,
in many cases two runs are
e, one using a resistive load, and
other the voice coil.
he resistive load set-up is similar
hat in Fig. 4b, while for a voice
measurement the load resistor is
oved and the voice coil connec-
s restored.
point to watch is frequency dis-
ination within the output meter,
ed by the blocking condenser at
low frequency end, and rectifier
city at the high frequency end.
e the blocking condenser is not
ted on the secondary side, make
it is out of circuit. In the event of a measurement being required across a push-pull primary circuit, the d-c blocking condenser may be dispensed with by connecting directly across the load.

In the case of a single output valve, where the reading would be affected by the voltage drop across the transformer primary, the only resource is to use a large high quality condenser—say a 4 mfd block type with an ample voltage rating.

High note loss is not a serious fault with modern copper oxide or miniature type rectifiers, but some of the older copper oxide types showed serious losses above about 500 cycles.

Voltages measured on the secondary side will be of a low order and this conflicts to some extent with the meter characteristics, which show non-linear tendencies below about one volt on the ten volt range. For this reason and in the interests of general accuracy, these readings should be kept reasonably high, while of course keeping clear of possible overload conditions.

THE SERVICEMAN WHO TELLS

(Continued from Page 49)

now has two crystal microphones—and a bottle of silica gel! Such is life.

Having, as one might say, made the "moist" of the wet weather, I turn to a couple of letters which were dug out with the scraps of paper referred to last month.

The first one takes me to task for a recent crack about paspalum grass. Says my correspondent: "You ought to own a dairy . . . you would realise the true value of this wonderful grass." Maybe, maybe, but I have no desires or aspirations along that line. As some would say: "Dairying is a cow of a job."

The second letter comes from the pen of a Victorian reader:—

DRIFT TROUBLE

After a few observations of radio impregnation—a la mouse—and the cone eating activities of the same little animals, he introduces the tale of woe. A popular and pre-war mantel set has been giving a lot of trouble from frequency drift. If tuned to a station, immediately after switching on, it will drift gradually to the high frequency side of resonance and requires re-tuning. If tuned to a station and then switched off overnight, it will be off-tune in the morning when switched on, but gradually drifts back into tune as the components warm up.

His attempts to cure the trouble have included the following measures:—

- Tried a new 6A7 converter,
- Removed and thoroughly cleaned gang,
- Replaced oscillator trimmer with different type,
- Fitted a new oscillator coil,
- Changed screen feed resistor and bypass,
- Changed supply and bypass to oscillator anode,
- Changed AVC bypass and feed resistor,
- Changed bias system for converter tube to cathode bias.
- Can the "Serviceman" suggest a means of fixing the trouble?

We must admit that it is rather a tall order. In the first place it is difficult to diagnose faults by proxy and, secondly, our friend has tried most of the remedies which I would normally have suggested.

Here are just a couple more, however, which are worth trying in any set which shows bad drift. Try a new oscillator grid condenser and grid resistor and try reducing the former in value to 50 pf. Also, check the dial cord or drive for "creep" due to temperature or humidity. It is just possible that an unsuitable dial drive cord may alter its length and shift the gang plates a trifle in relation to the dial.

In this case, seeking suggestions, I went to the length of asking the service department of the manufacturer concerned. Not much help was forthcoming, however, the voice at the other end suggesting that some frequency drift could be expected in the model in question, since it was built in the days when not so much was known about temperature correction. This coupled with a fairly sharp I.F. channel might be the sole cause of complaint.

Maybe it is, but a set that apparently drifts as much as this one would be a permanent pain in the neck.

What else then? Since the set is apparently temperature conscious, it may be possible to reduce the change in temperature in the oscillator valve.

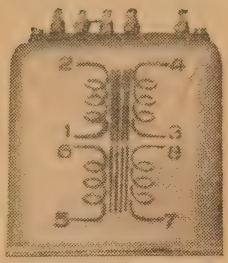
FEED RESISTORS

Without knowing the full details of the circuit, it would appear that the screen and oscillator anode feed resistors are quite low and that the operating voltages in the converter are correspondingly high. It would be worth trying the set with these voltages cut back deliberately, thus reducing the current drain in the converter. In the normal way it should be possible to cut the voltages by 30 or 40 per cent without doing too much damage to the performance.

Oh yes, one other thing. Clip the multimeter on to the B-plus line during a test and note whether the high tension voltage changes appreciably during the first half hour of operation. It is just possible that a slightly gassy output valve, or an open circuited AVC circuit, or such like is altering the total high tension drain and causing a drift in voltage.

Of course the AVC action with drift will have an evident effect but, assuming the set to be accurately tuned before each reading is taken, the voltage should be the same after half an hour as it was when the set is first switched on.

AMATEURS—DISPOSALS—EXPERIMENTERS



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Output—250 Volts at .06 Amps.
Size—4¼ x 2¾. Weighs only 3 1-8lbs. Perfect for use with 32 Volt domestic Receivers.
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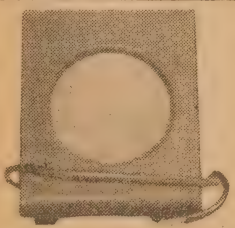

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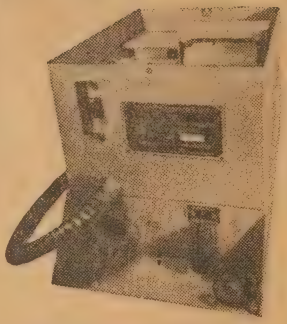

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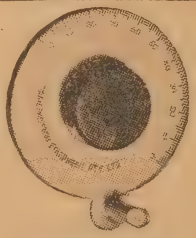

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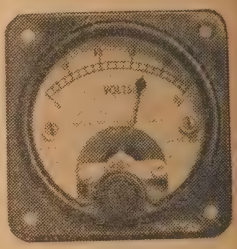

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25/- Post Free.
0-5 M.A. New in original cartons, made by Ferranti.
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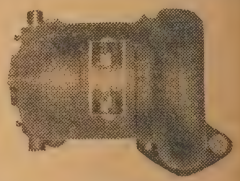

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NSWERS TO CORRESPONDENTS

. (Concord, NSW), tells of some nents with building a baffle box n ordinary radio cabinet.

ny thanks for your interesting which we have put aside for prob- e in the "Reader Built It" sec- he result could hardly be termed ed enclosure and it would be difficult to assess its performance atically. However, the general effect of the baffle on the speaker e quite effective as is apparently ut by your listening tests. The f in the treble register is only to ected with an ordinary speaker. dency is for them to produce more even output up to 5 or 6 kc then r off in efficiency. Thus even the higher frequencies may be quite clearly, the actual sound in- compared with that at say 3 kc, g way down. A changeover switch necessary to show the difference as the ear tends to ignore a taper off, as given by recorded cy discs.

(Marree, Central Australian Rail- forwards a subscription and also a change of address. He enquires the current consumption of a 6- ectric fan, and says the one he s hot after about half an hour's

hanks for your subscription J.R., has been recorded along with your of address. We do not know ect make of fan you have, but the ption of this type of fan is be- two and three amps. It is normal me heat to be generated, but it not be excessive. If there is ggestion of it being too hot to there would be something very al about it.

M. (Hamilton, NZ), writes to tell much he enjoys R & H and par- y "The Serviceman Who Tells" He also enquires as to the pos- ause of noise in his short wave d complains about interference stations by Australian stations.

any thanks H.K.M. for your letter ind remarks. In sensitive short receivers it is possible for noise generated by high resistance con- etween the various metal com- s and chassis. We suggest that eck the mounting of the dial on assis, and if necessary make pro- for a more effective contact be- the dial spindle and the dial plate. form of spring contact might be ed on the dial plate and arranged r against the dial spindle. Make the condenser rotors are well d. In an extreme case it is often to insulate the dial mechanism he condenser shaft. Unfortunately o not say which stations are in- in your interference problem, we are afraid we are not able r very much help. However you be able to compare your results omeone else in your district, and ine whether the effect is due to r or conditions.

H.C. (Pennington Terrace, SA), s us of a change of address. He sks about the method of feeding ush-pull valve from the screen of her.

our change of address had been The particular circuit is quite tory as a "free" method of obtain- ish-pull operation. It has a par- appeal in compact amplifiers, the number of stages must be yet high power output is re- The output can be balanced and wave form retained, provided both are operated under substantially lass A conditions. As the bias is sed above optimum, the wave form is sacrificed as full power output roached. The value of the screen nust be determined experimentally. rks out at 1500 ohms for the 6V6 e have never ascertained a value e CL4. As a pure guess, based on aracteristics, we would say about 750 ohms, which is of similar order to the EL3-NG.

J.E.R. (Yallourn, Vic.), is interested in the Diode Noise Generator recently described but suggests that we should go further and publish a table showing the relationship between plate current, line impedance and noise figure.

A. The article had already been prepared and appeared in the July issue. We trust that you have seen it in the meantime.

A & P (Boggabri), mention that ID8-GT valves are still available, though we inferred otherwise in our June issue.

A. Many thanks for your note. The point is that they are no longer regarded as a current equipment type and the market for them is purely a replacement one. As a result of this and the high price, valve distributors do not keep large stocks of them, they are absent from most dealer's shelves. Thus, while there may be a few odd ones around, they are not in plentiful supply. The policy of "Radio & Hobbies," on the other hand, is to use, as far as possible, valves which can be obtained readily and which are regarded as current production types by the manufacturers.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C GPO, Sydney.

A.H. (Dimbulah, Qld.), wants to know about the effect of RF energy or current passing through the human body.

A. We could not possibly undertake to discuss this subject and, in any case, it is one right outside the scope of our activities. As you will appreciate it has wide ramifications of a medical nature and the treatment is commonly used by medical men. The behavior of the current and the effect of frequency varies widely and liberties can be taken with RF energy which would be disastrous at the frequency of the power mains. Nevertheless, nasty burns can be sustained from RF energy if things go wrong. Generally speaking, the amount of energy in the aerial of an amateur transmitter is enough only to give a sensation of warmth. However, there may be spots on the aerial tuning circuits which are very "hot" for RF and possibly capable of giving a nasty burn. We've drawn off many an arc with a pencil but never been tempted to try it at closer quarters. When in doubt—don't!

M.T. (Woodville, SA), is interested in the "Karset" and wants to know whether this or a similar set would be suitable for use in a motor-cycle outfit.

A. Receivers for use in motor cycle outfits need plenty of audio power to overcome the noise of the engine and the air. Though we agree that battery drain is important, nothing short of a full-scale auto radio design is worth considering if you want signals as you go along. Where the set is used only while the outfit is stationary, an economical battery design would be the best choice. Our suggestion would be the All Battery Five. You can obtain details of the design through the postal query service. Should you decide on a battery receiver of this nature, it would be important not to operate the set while the battery is being charged from the generator. The rise in voltage could easily be sufficient to damage the valves.

B.E.M. (Corygulac, Vic.), writes to thank us for various articles in R & H and says he would like to see more space devoted to model planes.

A. We are unable to increase the proportion of space given to hobbies but you will doubtless appreciate some of the articles lined up for this section for the next few months. The fact that your crystal set received the low frequency stations but not the higher frequency ones may simply have been due to having too many turns on the coils. Of course, the higher frequency stations are less powerful than the others in this case, and it may easily have been this that made the difference. You did well, however, to receive anything over a distance of 100 miles. The small set you mention could be used as a portable but would hardly be as convenient to use and operate as a small superhet.

A.R.M. (Birrong, NSW), encloses the circuit of a large receiver, for possible review in our columns.

A. We have not had the opportunity to review your circuit, as yet, but we will put it aside for attention at the first opportunity. The general trend appears to be along well proven lines.

K.Mc.K. (Bondi, NSW), submits a circuit for comment.

A. Many thanks for the letter and for the circuit. We will give it our attention as soon as possible.

R.W.P. (address not clear), is interested in the "Senior Portable" and would like to know the date of the issue in which it was described.

A. The "Senior Portable" was described in the December, 1948, issue. In the January, 1949, issue we described a further version of the set under the title of "Universal Portable." This later set was arranged so that it could be operated either from its own internal batteries or from the AC power mains. Along with the descriptions of the "Universal Portable" we gave details of a large and effective loop which can conveniently be wound by the constructor. The loop may be used with either version of the set.

W.Y. (Geelong West, Vic.), makes some comments about long playing records which he recently heard, and also sends us some comment on this subject by the English magazine, "Gramophone."

A. Many thanks for your letter and the enclosed page, W.Y. It certainly seems that the sponsors of the new scheme have some teething troubles, at least, to overcome. We would not like to prophesy at this stage, just what is going to happen, and if any great change is to be made, how long it will take. However, there is no doubt that these records are offering something which the public want, and it does seem certain that they will enjoy a limited popularity.

Readers say:

78 RPM MOTORS

I refer to the article, Off the Record—News and Reviews, published in the current issue of Radio and Hobbies. This article refers to micro-groove recordings. The opinions you have given have rather upset me, as I have recently purchased an expensive gramophone motor, a one-speed Connoisseur and pickup.

You say in your article the new records will revolve at a speed of 33 1-3rd rpm. What is to become of motors like my own, and the newly-released Collaro RC 500? Are we to be forced to dump these expensive items in the rubbish heap because of the new speed?

Referring to my own motor, in the event of these micro-grooves being a success, could my own motor's speed be altered to suit the new speed? I think you could write an article in R. & H. on this matter, as there must be thousands of people who have bought expensive motors and are thinking the same as myself.

I think it is shameful for manufacturers to be putting these motors on the market knowing that they will have to be replaced late on. (H. Fitzsimmons, North Fitzroy, Vic.).

LP RECORDS

Some time ago you had an interesting article on long-playing records in R. & H.

Since then I had the opportunity of hearing some imported USA records and I was very disappointed. True, the surface noise was at a minimum, but fidelity was shocking and in three instances, distortion due to imperfect manufacture was terrific.

It is quite evident that a very high grade of expensive motor is necessary to ensure an absolute 33 1-3rd rpm and even then, carelessness in record processing will upset the whole show. Personally, I would not change from the standard 78's, particularly now English-made records are so easy to obtain.

In the April issue of the Gramophone, a most interesting survey of the long-playing records appears in the form of letters to the Editor, who, by the way, is very canny on LP's.

The comments bear out my own opinion. I think, in the course of time, a type of wire or tape-recording will be the solution of LP and that a commercial player at reasonable cost will evolve. (W. Young, Geelong West, Vic.).

The Editor's comments on this and the previous letter will be found in the News and Reviews columns on page 96.

32v. PLANTS

Some time last December I sent in a report on the voltage rise in the lighting plant as 45 volts, but since then have put in a new set of batteries and had the generator armature turned off. Now the highest reading I can get is 38v. The old batteries had two dead cells also. (M. W. Dutschke, Port Victoria, SA).

A COURSE IN TELEVISION

(Continued from page 65)

thought must be given to the coupling network as a whole, especially when it is remembered that frequency loss and phase shift tend to be accumulative over a number of stages.

In the face of obvious difficulties, some designers have adopted a system of low frequency compensation and a popular form is provided by the added components Rd and Cd.

By selecting the proper value for Cd, its reactance at most frequencies can be low by comparison with Rd. Under these circumstances, the plate load is provided by Rp only, and the mid-frequency gain of the stage is determined by it.

At the low frequency end, however, the bypassing effects of Cd can be made to diminish, so that the load becomes Rp and Rd in series, and the gain of the stage increases, thereby tending to cancel losses occurring in the coupling network or elsewhere.

Furthermore, the phase angle tends to oppose that due to the coupling network, so that the overall effect can be beneficial. The particular values for Rd and Cd depend entirely on the character of the compensation required.

Next month, we will turn our attentions to the high frequency part of the spectrum.

A NEW APPROAC TO HIGH-FIDELI RADIO RECEPTIC

(Continued from Page 33)

two diode load resistors R7.R8 nected in series at (X.X).

The R.F. choke offers high- actance to R.F. currents and di them to the salient via an "A" diode, during parts of positive cycles, relative to the character of one sideband. Then during of negative half cycles, relativ the opposite sideband, currents returned from the salient v reversed "B" side diode.

In operation, a positive bia approximately 0.2 volt, is de across R6 and shunts a d-c of a microamperes around the sal measured at (X.X.). This bias s the operating point of the cry to a more linear and efficient pa their characteristics.

When receiving a carrier, currents are rectified, diverted and-from the salient, and "Dyn Mean" voltages of opposite sign respectively developed on opp "A" and "B" sides of the dete positive at the top of R7, and ative at the bottom of R8.

Then, when modulation is imp sed on the carrier, the volt alternate about their "Dyna Means," but in phase opposition, a push-pull audio output is deli ed via the coupling condensers C12 to the grids of a push- amplifier.

Phase inverters are not requi The grid resistors of this first s of the audio amplifier possess a sistance which is relatively compared with the diode load R8, to maintain high modula capability in the detector.

The detector is very linear. It a relatively high conversion ef ency of more than 80 per cent a modulation capability of appr mately 98 per cent.

When setting up the salient de tor, failure might occur if too m reliance is placed on the posi negative markings on the crys Crystals should therefore tested for polarity, or direction rectification.

AN ELECTRIC MOTOR

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whole unit being securely bolte the base plate.

One method of connecting motor to the propeller shaft is making a close-wound spring f piano wire, screwing one end to motor axle and the other to the p peller shaft. This makes an ex lent universal joint.

Using a single "unit" cell volts), this little motor has dri a 16in model boat very easily ac a boating pond many times afternoon, and the battery was quite useful at the end of the If three or four "unit" cells are u a surprising turn of speed and po is developed.

MAKING THINGS FROM PERSPEX

(Continued from page 85)

When the mould has been prepared, and everything is ready, the blowing operation can be started. First, a piece of clean cloth is laid over the blowing table. This prevents the perspex from being scratched and also acts as a filter to stop any dirt that may be blown out of the air line.

Next, the mould is warmed to a temperature at which it can just be handled without too great discomfort. When these are ready the material which has been softening in the oven is taken out and laid on the base board and the mould quickly clamped into position.

The air is then turned on and the perspex is blown up into the mould. The pressure is maintained for about ten minutes by which time the material should have hardened. The mould is then removed from the base board and the finished product taken out.

AIR LEAKS

If there are any signs of an air leak in the blowing operation it is unlikely that good results will be obtained. Air leaks can usually be sealed by covering the edges of the mould that are in contact with the perspex with thin rubber of the type that is sold in sheets for patching cycle inner tubes.

It is unlikely that perfect results will be obtained at the first attempt. This may be due to several causes. The material may not have been warmed sufficiently in the softening process, or it may have been locally cooled by the mould or the blowing board. In either case the solution is obvious.

If satisfactory results have not been obtained at the first attempt the material is reduced to a flat sheet by re-softening in the oven and the process repeated.

With a little practice the correct technique is soon obtained.

There are many variations of the basic process described above. It is possible to blow shapes without a mould. In this case, the perspex is clamped down with a flat board in which a shaped hole has been cut. The material is blown up through this hole to the height required.

FINISHED SHAPE

The shape of the finished article is governed by the shape of the hole. Clear perspex blown in this manner has perfect optical properties and it is by this method that the transparent covers for aircraft cockpits are formed.

There is plenty of scope for experimental work by amateurs in working perspex. New methods can be evolved for special purposes, and the material can be applied to many new types of work. Great satisfaction can be gained from the fine finish and professional appearance of completed parts, and this will amply repay the time and effort put into the work.

WANTED TO BUY, SELL OR EXCHANGE

FOR SALE: (a) High tension power supply, input 240v, 50v, output 1200v at 200 M.A. D.C. Details: Bridge connected copper oxide rectifier with condenser choke, condenser choke, filter system, plus safety relay and stabilising resistor, wht. approx. 100lb. £17/10/-. (b) Admiralty transmitter, 4T, less power supply and valves, contains one 0-2.5A R.F. meter, 0-.2 R.F. meter and one 0-3A R.F. meter, special locking dials, plus relays, etc. wht. approx. 200lb. £15. **K. L. McLean, 60 Cabramatta Road, Cabramatta.**

FOR SALE: Transmitter, 50W. (815) on 50 Mc.—100W. (829) on 144 Mc. F.M. or A.M. Power Supply but no A.M. modulator. Also P38 Receiver, double conversion 9.72 Mc. and 465 K.C. crystal locked, full bandspread on 50 and 144 Mc., noise limited, S meter, low noise figure. Also materials for 4 element 50 Mc. and 8 element 144 Mc. beams. Reasonable offer for this and other receivers and VHF equipment. **Alan Llewellyn, 425 Blaxland Road, Ryde. VK2AH.**

FOR SALE: American Altec Lansing Duplex speaker with dividing network, new, £45. Large theatre L.F. baffle, dual, new, £10. Senior Magna Coustian sound head with stand, motor, magazines, etc., 35mm, £25. Amplifier 15 watts, 807's P.P. with speaker, output transformer, etc., complete, nearly new, £15. F.S.6., transceiver complete, good condition, £15. A.T.5 transmitter almost new with valves, £15. B.C. 453-Q-5er with 6 valves, £7. **J. W. Gerard, Coff's Harbor, N.S.W.**

FOR SALE: 1—5A4G valve, new; 2—6J7G valve, new; 2—807 valves, new; 1—H.2 Gang Stromberg condenser, new; 1—Red Line 385A side 80 mill power tran., new; 1—Red Line 6600 ohm power transformer, suit 807, new valve; 1—G12 magnetic speaker, Rola, new; 1—Zenith multi meter in carrying case, perfect order. Will sell separately or best offer. **R. Jenkins, Duvuney St., Cressy, Vic.**

FOR SALE: 3 S.C.R. 522 Transceivers 4:2 mfd. 1800v. Cond., 2 829B valves, 1—6 or 12v. input, 500v. D.C. output Genemotor. Command Rcr. for 14 mcs., 1 Command Rcr. for 27-28 mcs., 12 volt relays, etc. **Phone XB4427 or write H. G. Wilson, 23 Glenview St., Greenwich, Sydney.**

FOR SALE: Complete Ham Station 11 Tube double super xtal and audio filters, 100 watt transmitter with VFO and power supplies, class C wavemeter control equipment spares. Very high grade gear. **Box 12, Radio & Hobbies adv.**

FOR SALE: 2 Steel racks 3' x 2½' x 2'. Complete with chassis panels, etc, £5 each. Also transformers and chokes reasonably priced. Beginners' oddments given away. **D. Garlick, 70 Cavendish St., Stanmore. LA1327.**

FOR SALE: Quote your own prices. Will sell 25 years accumulation radio gear, parts, valves and magazines. Unique opportunity for new Hams. Write or telephone **Don B. Knock, 43 Yanko Avenue, Waverley, N.S.W. FW2443.**

FOR SALE: "Multi-Talkie" portable and cab. £10. "Ferrotune-Four" less cab., £10 or £19 the lot. Both comp, but circ. faults. Parts perf. **L. E. Svendsen, 162 Gaffney St., Coburg, Vic.**

FOR SALE: Plugs for BC-348 receiver, 4/- each. Partly assembled Palec valve, Cct tester including meter, panel, switches, xformer, circuit, as new, £6. **L. Hearnes, 80 Munro St., Coburg, Vic.**

FOR SALE: 5-watt Amplifier with pick-up, turntable and microphone. Built into three cases. Will sell units separately. After 5.30 p.m. **E. Furby, 24 Fraser Street, Dulwich Hill.**

FOR SALE: 5v Receiver, 3.3-50mc plug in coils, full b'spread. B.F.O., with pre-amp. aer. Tuner, in one cabinet. New cond. Best offer. **L. Menk, 1 Matthew St., Carnegie, Vic.**

FOR SALE: 1 Palec multimeter, dry rectifier type. Also 1 University VRM multimeter. Both good order. What offers? **L. J. Bone, Technical College, Lithgow, N.S.W.**

FOR SALE: New University Signal Tracer Mod. S.T.B. £10. **Furey, 28 Hampton Pde., W. Footscray (Vic.).**

FOR SALE: Tom Thumb 2 valve kit-set complete in cabinet, £5. **R. Burton, 17 Ridgewell St., Lakemba.**

FOR SALE: New acdc. multimeter cost £14. Sell for £12. Write **R. Faull, 38 Patton Street, Broken Hill South, N.S.W.**

FOR SALE: Plessey record changer, condition as new, £8/-/-. **E. Thomas, 14 Queen St., Enfield, N.S.W.**

FOR SALE: Copies R & H from Sept., '46. Valves: 6X5GT, 6X8G, offers. 144 **Barkly St., Ballarat.**

FOR SALE: Separate or together one VCT/V valve circuit tester, £15. One AWA mod. test oscillator, £18, as new, and hardly used. **W. De Lacey, Kennedy, N.Q.**

SALE English Recording Equipment (portable) Incorp. 20 watt amp 15,000 C.P.S., 3 mile inputs, magnetic cutting head, 2 S.T.C. M.C. mikes, 1 ribbon, cables, stands, transformers, &c. Portable P.U. for copies, cost over £400. Must sell, accept offer. **1 Elizabeth St., Parramatta, N.S.W. UW9302.**

SALE: Bendix type TA12C, converted for 80, 40, 20 (V.F.O.) bands. Perfect condition, complete with RF and MA meter and 24 volt genemotor. Also 3 807, 1 6V6GT, 1 1Q5G, 1 6SQ7GT, 4 954, 1 carbon and dynamic mic. 12 volt genemotor and 3.500 crystal, £40 lot or offer. **A. Buglee, Lisarow.**

SALE: 807 hi-fi triode amplifier 15 watt, 12 volt vibrator supply, Amplion 12" spkr. Crystal mike. Excellent performer. Good as new. Details. **Simpson, Orallo, via Roma, Q.**

SALE: R & H Dec., '46-Dec., '49, one or two missing. Details. **Simpson, Orallo, via Roma, Q.**

SALE: Radio College Serviceman's Course and all corrected question papers, £5. **D. Adams, 81 Beaumont St., Hamilton.**

SALE: 1 valve set, complete, cabinet, etc., except phones, superb range, £4/5/-. **D. Hayes, Box 351, Launceston, Tas.**

SALE: Complete set (8 volumes) applied electricity. Cost £20, never used. Take £15. **R. Smith, 55 College St., Drummoyne, Sydney.**

SALE: Calstan valve, circuit tester, £11/10/-. **25 Heighway Ave., Ashfield.**

SELL: Large quantity of Radio journals Australian and American "University" large scale ohmeter (as new). 10 watt push-pull amplifier, radiogram cabinet with motor pick-up. 2 portable cabinets (1) chassis complete, less valves, speaker, and dial. Collaro automatic record changer, brand new. **B. Cardwell, Langlang, Vic.**

SELL: Hallicrafter, S38, 117v A.C. D.C. tranny 240/110v. BFO, ANL, AVC, 4 range of freqs., 550 kc to 32 mc, noise limiter, CW, send/rec. switch band spread. Inst. book. £30. **16 Central Ave., Marrickville, N.S.W.**

SELL: Generator, 500v 400ma., 10v. 10a., (variable). Good Order, £10 or offer. **P. Day, Wireless Station, Ballan.**

SELL: AWA 3B Trans rec equip., complete, perf., £60, offer. 6v supply for National HRO, new, £5. Pair 829B,, £4½ ea. new, 5' 6" rack, 14" wide, total enclosed., £5. **Butler, 1 Darley Rd., Randwick.**

SELL: University supertester, oscill £25 worth new radio parts incl valves. The lot for £40. Apply **Selle, Pomona, Qld.**

SELL: Phillips 2" cathode ray os scope, type TA155, as new, £30 or **D. Chambers, C/o Camp Office, R.G.H., Concord.**

SELL: New 12w AMP G12 spkr, £17. 5v A.C./B.C. mantel chassis, com £13. G12 spkrs., £4 each. Offers. **Fuss, 49 Balmain Rd., Leichhardt, N.**

SELL: 1T4 one-valve set, new valve batteries, less phones. **T. S. Stawell, Vic.**

WANTED: Palec VCT multimeter tester. Good order. **Smith, 5 Sa Bay Road, Willoughby, Sydney.**

WANTED to buy one 6 volt, and 32 volt windcharger. **A. A. Mo Yeppoon, Queensland.**

WANTED: Base sections type F co coated steel whip antenna. **Titanga, Lismore, Vic.**

WANTED: Transceivers—2—FS6, plete, new. Aerial, wavemeter, lot. **N. West, 2 Queens Rd., SC2,**

WANTED: Circuit of AR7 receive **Carter, 39 Bareena St., Strath**

WANTED: Urgently, Long resist screen, electrostatic deflection, tube. **West, Ferguson Sq., Tusmore,**

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